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PERCEPTUAL AND RESPONSE ABILITIES OF MENTALLY RETARDED CHILDREN.

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SOUTHERN ILLINOIS UNIV., CARBONDALE

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THE BASIC INTENTION OF THE STUDY WAS TO INVESTIGATE MENTAL RETARDATION IN TERMS OF PERCEPTUAL AND RESPONSE ABILITY DEFINITIONS, TO TEST THESE ABILITY DEFINITIONS OBJECTIVELY, AND TO EVALUATE THEM AS THEY RELATE TO THE INTELLIGENCE FACTOR. BOTH PERCEPTUAL AND RESPONSE FACTORS WERE EXAMINED FROM THE STANDPOINT OF MENTAL DISTURBANCES WITH REFERENCE TO THE MODALITIES OF VISION AND AUDITION. DETAILED DATA WERE GATHERED ON APPROXIMATELY 200 CHILDREN DRAWN FROM MAJOR CLASSIFICATIONS--(1) CHILDREN WITH AT LEAST NORMAL INTELLIGENCE, (2) MENTALLY RETARDED CHILDREN ATTENDING SPECIAL CLASSES, AND (3) MENTALLY RETARDED CHILDREN WHO WERE INSTITUTIONALIZED. USING THREE GENERAL AREAS OF INVESTIGATION--(1) CLINICAL PSYCHOLOGY, PROVIDING PERTINENT MATERIAL AND A PRETEST MEDICAL EVALUATION TO ASSIST IN DETERMINING ORGANICITY, (2) VISUAL MODALITY, AND (3) AUDITORY MODALITY. PERCEPTUAL PROCEDURES USED WERE CLASSIFIED "PSYCHOPHYSICAL" (THE EASE WITH WHICH THE DISCRIMINATIVE STIMULUS IS SPECIFIED), REQUIRING CONSIDERABLE INSTRUMENTATION AND A NUMBER OF PRESENTATIONS FOR STIMULUS CONTROL, AND "OTHER PERCEPTUAL" (THE DIFFICULTY OF SPECIFICATION) WITH PAPER AND PENCIL TESTS OFTEN USED. WHEN THE MULTISTUDY EFFORT WAS CONCLUDED, MORE LABORATORY RESEARCH WAS CONSIDERED NECESSARY TO DEVELOP A DETAILED CLASSIFICATION AND CONTROL METHOD FOR THE NUMEROUS PERCEPTUAL RESPONSE VARIABLES OBSERVED AND, FURTHER, TO ATTEMPT TO DEVELOP AND TEST, ACCORDING TO THESE CLASSIFICATIONS, GOOD EDUCATIONAL AND TRAINING METHODS FOR THE MENTALLY RETARDED. (JH

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**Responses of Retarded and Normal
Children to Selected Clinical Measures**

By Leslie F. Malpass, Ph.D.

**Perceptual and Response Abilities of
Mentally Retarded Children as Mea-
sured by Several Auditory Threshold
Tests**

By Chester J. Atkinson, Ph.D.

**Visual Signal Detection, Perception,
and Response Variables as Functions
of Development and Mental Retarda-
tion**

By Israel Goldiamond, Ph.D.

With a Preface by John O. Anderson, Ph.D.



The research reported herein was performed
pursuant to a contract with the United States
Office of Education, Department of
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**PERCEPTUAL AND RESPONSE ABILITIES OF
MENTALLY RETARDED CHILDREN**

**U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
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**Southern Illinois University
Carbondale, Illinois**

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Cooperative Research Project No. 176(6471)**

PREFACE

The problem of mental retardation has long been one of the vexing problems facing all school administrators and indeed all society. Only in recent years, however, has public awareness of its impact and the possibility of minimizing this impact brought about sufficient interest and financial support to approach the problem from a research standpoint.

In 1957, four faculty members at Southern Illinois University became interested in this problem and subsequently submitted an application for financial assistance to the United States Office of Education. A contract was arrived at and a two-year interdepartmental study was undertaken.

Dr. Chester J. Atkinson, of the Department of Speech Correction, Pathology and Audiology, investigated auditory perception and the responses to auditory stimuli. Dr. Israel Goldiamond, Experimental Psychologist in the Department of Psychology, investigated visual perception and responses to visual stimuli. Dr. Leslie F. Malpass, Clinical Psychologist in the Department of Psychology, investigated the clinical psychology areas which seemed important as a means of relating data to psychological make-up of the subjects. Dr. John O. Anderson, Coordinator of Research at the University, served as coordinator of the project primarily in terms of fiscal and administrative matters.

This final report of the project is being prepared as follows:
(1) an introductory statement and brief summary of the research, and

(2) detailed reports as prepared by each of the three principal investigators.

It was the basic intention of this study to investigate the mentally retarded in terms of perceptual and response abilities. These perceptual and response abilities were to be tested objectively and evaluated in terms of a continuum utilizing intelligence as its base. The investigators felt that it was important to know whether the generally accepted picture of retardation was a function of perceptual disturbances, response disturbances, or both. It seemed logical to assume that if this information could be forthcoming, the implications for education would be great. The child, for example, who was slow because of perceptual difficulties, would seem to require different education and training from that child whose retardation could be attributed to a difficulty in making a given response but had no difficulty in perceiving the stimulus. To go a step further, if these problems seemed to be more closely related to the visual or auditory modalities, educational processes would again be affected.

In the course of the study, data was gathered on 218 children drawn from three major classifications: (1) children with at least normal intelligence; (2) mentally retarded children attending special classes throughout Southern Illinois; and, (3) mentally retarded children who were institutionalized. It was, of course, impossible to gather identical information on all subjects. The detailed data gathered on each case are reported in the body of the report.

As has been stated previously, three general areas of investigation were involved: (1) the clinical psychology data necessary to provide pertinent material and also a pre-test medical evaluation to

assist in determining organicity; (2) the visual modality; and, (3) the auditory modality. In the early stages of the study, a variety of tests and measures were investigated in terms of their applicability to this study. For example, in the visual modality, movement discrimination, form and size discrimination, and flicker-fusion were among the measures investigated. In the auditory modality, patterns and tones, flutter, intensity and sound localization were among the variables investigated. In the clinical psychology aspect, many normal or standard tests such as the Wechsler Intelligence Scale for Children, the Stanford-Binet, the Thematic Apperception Test, and the Rorschach were evaluated in terms of their use in this study. After an initial phase which investigated the above mentioned approaches, those tests or measures which seemed to be most suitable were selected for actual use. In addition, it was necessary to construct some special rating scales and measures for use with this particular population. For example, a special rating scale was developed in the psychological portion of the study, special visual films were constructed for utilization in the visual modality, and a modification of the Eye-Puff technique in audiometry was utilized in the auditory modality. Details of these developments are contained in each of the individual reports.

In addition to the special procedures noted, laboratory equipment was constructed for this project whose applicability may not be limited either to this project or to the problems investigated. Among this equipment were two mobile laboratories, which brought the laboratories to the children. One mobile laboratory was a fully equipped audition laboratory, containing three sound-isolated cubicles, and housed in a large truck. The other mobile laboratory was a vision laboratory fully

equipped to duplicate a campus laboratory, containing a psychophysical booth, a perception room, and controls, and housed in a large trailer. Both mobile laboratories have met the test of use for extended periods of time by children of varying ages, intelligence, and levels of activity. Use of such equipment enables investigators to bring highly controlled laboratory environments to areas where such are not available, and to compare results with those obtained with other populations.

Perhaps the most efficient way of summarizing in a general way the results of the study is to provide here in the words of each investigator the abstract for each individual section.

Responses of Retarded and Normal Children to

Selected Clinical Measures

By Leslie F. Malpass

"This study determined that the following clinical measures differentiate retarded children (both institutionalized and educable mentally handicapped) from normal children of comparable ages (range 9-14 years, mean age 11 years) at highly significant levels of confidence: (1) Raven's Progressive Matrices (1956 edition); (2) Oseretsky Motor Development Scale (Lincoln revision); (3) Children's Manifest Anxiety Scale; (4) certain aspects of figure-drawings presumed to represent personality variables; (5) Vineland Social Maturity Scale (used with EMH and normal children only); and, (6) several general cultural, familial and developmental considerations evaluated by means of the case history method. In addition, differences between institutionalized and educable mentally handicapped children, in favor of the latter, were found in their responses to the Children's Manifest Anxiety Scale and for certain aspects of their human-figure drawings and case study data.

For both retarded and normal groups, significant relationships occurred between the criteria of intelligence (both MA and IQ) and the Progressive Matrices and the Motor Development Scale. No relationships between measures of intelligence, anxiety and social maturity were found, although such relationships have been reported by other investigators. This study indicates that the 1956 edition of the Progressive Matrices, the Children's Manifest Anxiety Scale and the Oseretsky Motor Development Scale, none of which has been extensively used heretofore in investigations of retarded children, can yield valuable research data about such groups, as well as about normal children.

Another phase of the study revealed meager but genuine relationships between teacher ratings of the school behavior of EMH and normal children and the children's rated attitudes about school.

One unexpected finding was that EMH girls scored lower on most measures than EMH boys, although there were no differences within the sex-groupings of institutionalized and normal children. Also, there were far fewer girls than boys in EMH classes. One implication of these findings is that, in order to be included in special classes, girls must be more notably retarded in many aspects of behavior than boys. This further suggests that educators might profitably review the criteria which are used to place children in EMH classes.

In addition to determining the information given above, the study served to identify subjects for investigations dealing with perceptual and response abilities of retarded and normal children conducted by Dr. Chester Atkinson (hearing) and Dr. Israel Goldiamond (vision)."

Perceptual and Response Abilities of Mentally Retarded Children as
Measured by Several Auditory Threshold Tests

By Chester J. Atkinson

"The literature in the area of testing the hearing of the mentally retarded is to date in unanimous agreement that there is greater incidence of Hearing Loss among the mentally retarded than among normal populations. The percentage of Ss exhibiting significant Hearing Loss is to an extent a function of two procedural variables; the test and indicator used to assay hearing potential, and the criteria selected to define significant Hearing Loss.

Two major objectives of the project were: (1) to get a comparable measure of Hearing Loss on institutionalized mentally retarded children, non-institutionalized mentally retarded children, and a control group, (2) to obtain these measures by several test procedures. These test procedures varied with regard to the response used to indicate hearing, the rationale being that the sensory processes of the mentally retarded child are essentially the same from test to test and that variations in the Hearing Loss measures are a function of the test and of the response indicator used. The tests from which data are reported are: (1) Standard Audiometer test, (2) Eye-Puff test, (3) Four-Choice Forced-Choice, (4) Békésy test. Each of these tests required a distinctly different response to indicate hearing.

The data also indicate there is not a greater incidence of significant Hearing Loss among the mentally retarded tested than among a comparable normal group.

This study was facilitated by the use of a mobile research unit, a large truck with an enclosed body into which were fitted three sound-isolated cubicles."

Visual Signal Detection, Perception, and Response Variables as
Functions of Development and Mental Retardation

By Israel Goldiamond

"A series of psychophysical tasks, perceptual tasks, and other response tasks were run in an experimental analysis of perceptual responses of mentally retarded and normal children of various ages.

The major results obtained were the following;

1. Voltage required for signal detection (forced-location) was independent of IQ, but varied inversely with age.
2. Reaction time was an inverse function of both age and IQ.
3. Children with lower IQ's gave consistently more overestimative responses in signal detection (Yes-No), used more definite responses, gave more false alarms, reported more signal detection at intensities too low for accurate location, than did normal children, for whom such responses tended to diminish with age. Retarded children also overestimated in size constancy tasks.
4. Retarded children also took more time to complete tasks, and there was considerable response attenuation in the absence of training and prompts.
5. Curves and data considered developmental were replicated using certain combinations of procedures, but other results were at times obtained when other procedures, in some cases involving more valid conditions were utilized.

6. Proportions of color blindness found in normal and retarded populations were identical with general population proportions.

Implications for perceptual research were discussed. Perceptual procedures were classified into two types, called psychophysical and other perceptual. The first of these is characterized by the ease with which the discriminative stimulus is specified (for example, a defined spot of light of a given intensity), and the second by the difficulty of specification (the Titchener circles, for examples). The first of these procedures is difficult to administer, requiring considerable instrumentation and number of presentations for stimulus control. The second is easier to administer, with paper and pencil tests often used. It was suggested that the psychophysical procedures which have usually been neglected in research in development and retardation, may supply data of importance in these areas, since the greater specifiability of procedures which characterizes them facilitates the isolation of the variables operating.

A methodology was suggested which might facilitate specification of perceptual and nonperceptual variables. Application of these methods to the children of this study suggested that some elements of the picture of development of perception with age currently extant may be functions of the procedures used, rather than of perception, with similar questions being raised with regard to retardation of perception. These results may relate to development (and retardation) of nonperceptual contributions to the variants of the perceptual response.

Implications for educational practice and research were discussed. It was suggested that the overestimative behaviors found in the retarded might be related to variables associated with the segregation of retarded

from normal children. Such segregation was related to educational necessities of not retarding normal children, and teaching retardates at their own pace. Alternative procedures were considered. Specifically, it was suggested that whereas aversive consequences applied to overestimative behaviors of normal children tended to attenuate such responses as a function of prolonged exposure to such socialization, acceptance of such behaviors of retardates by teachers in special classes may continue then at the high levels noted. Regarding the problem of perceptual response attenuation in retardates, which makes perceptual experimentation difficult with these subjects, it was suggested that this might be resolved through research in the application of procedures currently developed in laboratory control of behavior of individual organisms.

It was concluded that further laboratory research may provide specification and control of the variables operating in perceptual responses."

The principal investigators have indicated that they feel the study has been most worthwhile. Their enthusiasm is shared by administrative officials of the University who have come in contact with the project and it is hoped that as the reader studies the following reports the information contained therein will suggest future investigations which will contribute to the solution of this educational and social problem.

John O. Anderson
Assistant Dean,
Coordinator of Research
Graduate School
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SECTION I

**RESPONSES OF RETARDED AND NORMAL CHILDREN TO
SELECTED CLINICAL MEASURES**

By

Leslie Malpass, Ph.D.

ACKNOWLEDGEMENTS

The major source of support for this study was provided through the Cooperative Research Program of the United States Office of Education, Department of Health, Education, and Welfare. Acknowledgement for this support is gratefully given.

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Mr. Ronald Brown, Mrs. Sylvia Mark and Mr. Donald Hake served as research assistants. They helped collect, score and tabulate the data, and made many valuable contributions by their suggestions.

Mr. Harry Beck and Mr. Frank Lentz, Area School Psychologists, West Frankfort, Illinois, and Mr. William Chambers, Chief Psychologist, Lincoln State School and Colony, contributed immensely by testing some of the retarded children and by providing other information about them that was used in the case studies.

Teachers of the educable mentally handicapped and normal children in Carbondale, Christopher, Herrin, Marion and Murphysboro, Illinois, and attendants at the Lincoln State School and Colony, were helpful by seeing that children were on time for their testing appointments.

Dr. Richard Melton, Department of Psychology, and Dr. A. M. Mark, Mathematics Department, Southern Illinois University, generously gave their time and efforts to help plan and implement the statistical analysis. Dr. Mark supervised the IBM processing of the correlational data.

Dr. David Palermo, University of Minnesota, Dr. Charles Smock, Purdue University, Dr. James Gallagher, University of Illinois, Dr. Irwin Berg, Louisiana State University, and Drs. Bonnie McKay and Oliver Kolstoe, Southern Illinois University, served as consultants for different aspects of the study. Their comments and suggestions were stimulating and helpful.

Drs. John Anderson, Chester Atkinson and Israel Goldiamond, the other Principal Investigators in the project covered by this research contract, made many contributions by their provocative questions about, and their considered judgments of, the plans and procedures used in this part of the total project.

Finally, Mrs. Shirley Lyle, Mrs. Peggy Tarrant and Miss Marilyn Lanton provided secretarial assistance in preparing the format and in typing and proofreading the manuscript.

ABSTRACT

This study determined that the following clinical measures differentiate retarded children (both institutionalized and educable mentally handicapped) from normal children of comparable ages (range 9-14 years, mean age 11 years) at highly significant levels of confidence: (1) Raven's Progressive Matrices (1956 edition); (2) Oseretsky Motor Development Scale (Lincoln revision); (3) Children's Manifest Anxiety Scale; (4) certain aspects of figure-drawings presumed to represent personality variables; (5) Vineland Social Maturity Scale (used with EMH and normal children only); and, (6) several general cultural, familial and developmental considerations evaluated by means of the case history method. In addition, differences between institutionalized and educable mentally handicapped children, in favor of the latter, were found in their responses to the Children's Manifest Anxiety Scale and for certain aspects of their human-figure drawings and case study data.

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CHAPTER I

PURPOSE AND RATIONALE OF THE STUDY

This part of the study was undertaken in order to accomplish several purposes. First, it was necessary to define the normal and retarded groups by using standardized measures of intellectual ability. This would permit differentiating normal from retarded children on the perceptual-response ability measures administered by the other two principal investigators. Second, it was presumed that the retarded children could be differentiated from the normal group in terms of certain personal-social and school behaviors. Several measures were available which previously had shown promise for evaluating either normal or retarded childrens' abilities, and two of them (the Oseretsky Motor Development Scale and Vineland Social Maturity Scale) had been used to compare normal and retarded children. It was presumed that these behavior measures might be related to each other. Third, it was felt that motor proficiency, self-reported "manifest anxiety", and other abilities and characteristics which could be evaluated by a projective test, case history procedures, a social maturity scale, and a health status examination, might be related to the perceptual and/or response abilities measured by the other principal investigators. For these three major reasons, then, this part of the study was undertaken.

Of secondary importance to the total study, but of great interest to the principal investigators involved, was the possibility for

evaluating the usefulness of some of the measures which were to be used either for the first time in research with retarded children (e.g. Children's Manifest Anxiety Scale), or with children in this country (e.g. Progressive Matrices, 1956 edition), or which previously had not been reported in research literature as being used with particular groupings studied in this investigation (e.g. Oseretsky Motor Development Scale, to compare educable mentally handicapped with institutionalized retardates). A secondary purpose of this part of the study, then, was to compare some new and rarely used, though promising, measures of personal-social behavior and school ratings and inventories.

In order to state the purposes more effectively, the following hypotheses were made:

Hypothesis I. Responses of retarded children, both educable mentally handicapped and institutionalized, will be significantly different from those of normal children not only on measures of general intelligence by which they are categorized, but also on measures of specific intellectual ability, personal-social behavior, ratings of school behavior, and health status.

Corollary 1, Both EMH and institutionalized retardates will receive significantly lower scores than normals not only on measures of general intelligence (individual and group IQ tests) but also on a measure of specific intellectual ability (Progressive Matrices).

Corollary 2. Both EMH and institutionalized retardates will demonstrate significantly more deviant responses or ratings than normal children on the following measures of personal-social behavior:

- (1) Oseretsky Motor Development Scale (Lincoln revision)
- (2) Children's Manifest Anxiety Scale

- (3) A detailed case history and developmental schedule
- (4) Draw-A-Person technique
- (5) Vineland Social Maturity Scale

Corollary 3. Retarded children will give responses to a structured interview indicating less effective school behaviors than normal children. Teachers will also indicate by ratings that retardates demonstrated less effective school behaviors than normal children.

Corollary 4. Retarded children will demonstrate more health problems and physical deviations than their normal counterparts.

In addition to testing this Hypothesis and its corollaries, comparisons of EMH and institutionalized retarded children will be made on the measures noted in the corollaries above, where feasible.

Hypothesis II. There are significant relationships between measures of intellectual ability and of personal-social behavior, and among the measures of personal-social behavior for both retarded and normal children.

Corollary 1. For the retarded and normal children, there are significant relationships between the measures of general intelligence and the following measures:

- (1) Progressive Matrices (1956 edition)
- (2) Oseretsky Motor Development Scale
- (3) Children's Manifest Anxiety Scale (inverse relationship expected.)
- (4) Vineland Social Maturity Scale

Corollary 2. For retarded and normal children, there are significant relationships among the measures listed in Corollary 1 (i.e. each measure will correlate with every other measure).

Hypothesis III. Significant relationships exist between teacher ratings of children's behavior and the children's rated responses about school.

Hypothesis IV. Institutionalized retarded children will demonstrate significantly more deviant scores than non-institutionalized retarded children on all the measures noted in Hypothesis I, corollary 2 above.

Chapter II of this section describes the various measures used and the administrative scoring and statistical procedures, and Chapter III of this section reports the results obtained. The summary and conclusions are contained in Chapter IV.

CHAPTER II

PROCEDURES

Population Sample

Subjects for this study comprised two general groups, retarded children and their normal controls. Retarded Subjects were selected from educable mentally handicapped classes in public schools and from a state school. Table 1 gives data about ages of the population sample.

TABLE 1
MEAN AGES OF POPULATION SAMPLE

	EMH		Lincoln		All Retards		Normal	
	N	Mean CA	N	Mean CA	N	Mean CA	N	Mean CA
Boys	40	11.69	34	11.73	74	11.73	43	11.69
Girls	16	11.87	23	11.98	39	11.93	26	11.75
Totals	56	11.74	57	11.86	113	11.80	71	11.71

EMH children were from special classes in Carbondale, Murphysboro, Herrin, Marion and Christopher, Illinois. Institutionalized retardates were from the Lincoln State School and Colony, Lincoln, Illinois. Control Subjects were selected from public schools in the communities mentioned above. Ages ranged from eight years three months to sixteen years three months. However, only the 186 children fourteen years and younger were included for most analyses using standardized

testing procedures.

Since retarded children were the easiest group to define, they were used as the population against which controls were matched.

It was intended to match normal children with retardates in terms of sex, age, school (except for institutionalized Ss) and general socio-economic background. A three month deviation in CA was used as the limit for age-matching. This was considered the most crucial matching variable and was observed in all but three cases, where it was necessary to use a four month CA interval. School authorities (normally a teacher and principal) gave estimates of the neighborhood, home and family information which served as indices of socio-economic background factors. The latter proved to be very crude matching criteria, however, and in the statistical treatment of data the groups were treated as independent samples rather than as matched-pair groups.

Measuring Instruments

Various instruments were selected to measure the characteristics outlined in the hypotheses. The instruments were categorized in terms of the major types of behaviors which were considered relevant to the study. The major categories were, Measures of Intellectual Ability, Measures of Personal-Social Behavior, Measures of School Behavior, and Health Measures. Specific measures were used to investigate behaviors of both groups of retarded children and normals. Procedures used in administering, scoring, and analyzing the data from the measures are given below. In addition to determining any differences which might have occurred between the groups, intercorrelations were run between the measures. These procedures are described in the last section of the chapter.

Measures of Intellectual Ability

Two tests of mental abilities were used in this study to designate intelligence level. The Wechsler Intelligence Scale for Children (WISC) was used with retarded children and the California Test of Mental Maturity (CTMM) was used with normals. A third measure, Raven's Progressive Matrices (1956 edition) was used to evaluate a specific type of intellectual function, ability to reason by analogy.

Wechsler Intelligence Scale for Children.--This test was published in 1949 as a downward revision of the adult Wechsler (1949) scales. It is recognized as one of the most valid and reliable tests of general intelligence for children and has been used as a criterion in many researches about retarded as well as normal Ss. It is so well-known that a detailed description is deemed unnecessary.

The WISC was administered individually to all retarded Ss, both EMH and institutionalized. Scoring followed usual procedures. Analysis of the data includes only Full Scale IQs.

California Test of Mental Maturity.--The 1957 revision of this test was used to measure intelligence of normal Ss. It was selected for this purpose when it became apparent that it would not be possible to test all normals with individual WISC's due to time limitations. Part of these limits stemmed from objections of school personnel to releasing children from class work for the hours required by all three investigators. The CTMM total IQ correlates with the Full Scale WISC IQ at .81 (Altus, 1952).

The CTMM was administered to groups of four to six Ss at a time, although a few were administered individually. Analyses were made in terms of total IQ scores.

Because the IQ scores for the retardates and normals were obtained by different tests, a t-test for independent samples was run to determine whether differences between these groups were significant and, among retardates, whether significant differences between EMH and institutional retardates were obtained.

Progressive Matrices (1956 revision).--This test (Raven, 1956), a revision of the 1949 edition of the Standard Progressive Matrices, is described as a test of observation and clear thinking. It is composed of three scales containing twelve items each. Items are constructed to measure "the ability to reason by analogy as a consistent method of inference" (Raven, 1956, Page 1). The author of the test feels this is one of the most crucial, therefore one of the most valid, of all intellectual abilities. Retest reliabilities of .86-.90 are reported and internal consistency r's of the scales vary from .64-.83. The Guide reports a correlation of .90 with the Stanford Binet (normal children).

One of the purposes for including this test was to establish a validity coefficient of the scale for American children using the WISC scores as criterion for retarded Ss and the CTMM scores as criterion for normals. The PMT was standardized on English children from five to eleven years of age. However, since no child in our study through the age of thirteen successfully completed all items, correlations include children through this age group.

The Matrices were administered individually to all Ss, regardless of intelligence classification. Administration required from eight to twelve minutes and scoring procedures required two to three minutes per test. Raw scores were used for purpose of data analysis, since percentile scores given in the Guide were considered too crude to

be used for correlational purposes.

t-tests were used to determine if significant differences occurred between scores of retardates and normals and, among retardates, between EMH and institutionalized retardates.

Measures of Personal-Social Behaviors

The principal investigators deemed it advisable to include measures of personal and social behaviors in order to determine whether retarded children would be differentiated from normals in terms of these criteria as well as in terms of intelligence. In pilot studies, non-institutionalized retardates gave such barren Rorschach and TAT protocols that the use of these techniques seemed inappropriate. Therefore, Ronald Brown (1958), a graduate assistant working under Dr. Malpass, devised a multiple-choice apperception test to get at variables measured by other projective methods. However, this test, too, was not considered adequate for the purposes desired and it was not used.

The measures used to evaluate personal-social behaviors included the Oseretsky Motor Development Scale, the Children's Manifest Anxiety Scale, the Draw-A-Person technique, a case history which included family, neighborhood and school information as well as a developmental history, and the Vineland Social Maturity Scale. These measures, together with procedures for administration, scoring and analysis, are described below.

Oseretsky Motor Development Scale.--The Lincoln adaptation of the Oseretsky Scale (Sloan, 1955) was used to measure motor ability of the children in this study. Sloan (1948 & 1955) adapted the Vineland revision of the original scale so that it includes 36 items involving a wide variety of motor skills. This adaptation was standardized on 380

boys and 369 girls, all from Central Illinois, between six and fourteen years of age. A copy of the scoring blank can be found in the Appendix. The background, rationale, the development and standardization of procedures, and normative data are included in Sloan's monograph (1955). It is felt that a review of these aspects of the scale is not necessary here.

The OMDS was administered individually to all Ss fourteen years and younger included in the study according to the procedures given in the manual. Raw scores were used for purposes of analysis. t-tests for independent samples were used in comparing the various groups.

Children's Manifest Anxiety Scale.--The CMAS (Castaneda, et al., 1956a) is a revision of Taylor's (1953) manifest anxiety scale, originally intended for use with children in the fourth through sixth grades. The scale is composed of forty-two items presumably dealing with fears, worries and concerns of children and eleven items are used to measure inconsistency or falsification of report (Lie-Scale). Each item is checked YES or NO by the S. It has been found to be reliable (Castaneda, et al., 1956a), somewhat related to school achievement and intelligence (McCandless, et al., 1956a), to social status (McCandless, et al., 1956b) and performance or learning tasks (Palermo, et al., 1956). Wirt and Broen (1956) reported that the CMAS does not correlate well with a "clinical concept" of anxiety. However, the items by their very nature are concerned with fears of children.

The CMAS was administered individually to all Ss. Because of reading deficiencies in retarded children, the items were read to these Ss. A check was made to determine whether these Ss understood the items by asking for an example or explanation every seven to ten items. Nor-

mal Ss were permitted to read and answer the items themselves. Scoring of the CMAS is in terms of number of YES responses (presence of "anxiety"). Raw scores provided the data for analysis of results.

As with previously described measures, t-tests were used to determine if the groups, both among the retarded children as well as between retarded and normal Ss, could be differentiated.

Draw-A-Person Technique.--The Draw-A-Person technique (DAP) has been widely used as by clinicians to assess personality variables. Swensen (1957) recently reviewed the literature about the DAP and concluded that research findings do not confirm the claims of some advocates of this method, notably Machover's (1949). However, there is some evidence which supports the use of the DAP as a screening device for large groups and as a "gross indicator of level of adjustment" (Swensen, 1957). Swensen also suggested that some of Machover's specific hypotheses needed further testing. The DAP was included in this study because, as a technique, it was possible to obtain scorable responses from retarded as well as from normal Ss which would yield information and serve to test hypotheses about behavior variables of children in these groups.

Standard administration procedures were observed and the test was given individually to each S. S was handed a piece of standard size white bond paper and a pencil with the following oral instructions: "Draw me the picture of a person on this sheet of paper." Observations about time, origin and direction (e.g. head to toe) of the drawings, and remarks made during the drawing, were recorded by E. When the first figure drawn was of the same sex as S, E said, "Now tell me a story about the figure you have drawn. Tell me as good a story as you can." E then recorded Ss statements. With most retarded Ss and some normals,

it was necessary to prompt S with statements such as "Tell me more", "Tell me how old this person is", "Tell me something about what he likes and dislikes". If S first drew a figure opposite in sex to S, a new sheet was presented and S was told: "Now draw me a person of the opposite sex". The instructions above were again given to S. In most instances the same sex figure was drawn first. The same request for a story was made after both drawings, however, no matter in what order the figures were drawn.

Twenty-six aspects of the drawings were scored. These particular variables were included because each one has been included in at least one other study and many of them have been reported to differentiate retardates from normals (Weider and Noller, 1953; Swensen, 1957). Variables were scored according to the following criteria:

<u>Variable</u>	<u>Scoring Criteria</u>
(1) Size of drawing:	(1) less than $\frac{1}{4}$ page in length and width (2) over $\frac{1}{4}$ page in length but not in width (3) over $\frac{1}{4}$ page in width but not in length (4) over $\frac{1}{4}$ page in width and length
(2) Location of drawing- (at least 75% of drawing occupied):	(1) upper left quarter of page (2) upper right quarter of page (3) lower left quarter of page (4) lower right quarter of page (5) center quarter
(3) Perspective:	(1) facing forward (2) facing sideways (3) confused (combination of front and side)
(4) Head size:	(1) less than $\frac{1}{2}$ the length and width of trunk (2) over $\frac{1}{2}$ the width of trunk, less than $\frac{1}{2}$ the length of trunk (3) over $\frac{1}{2}$ the width of trunk, more

than $\frac{1}{2}$ the length of trunk.

- | | |
|--------------------|---|
| (5) Mouth: | (1) single line ("slash")
(2) 2-dimensional ("lips") |
| (6) Balance: | Determined by an overlay grid. If one or both legs off the vertical plane for head, rated "off-balance." |
| (7) Activity: | Any type of presumed motion exclusive of discrete arm position. (two judges had 90% agreement on such ratings.) |
| (8)-(25) Included: | Presence of these was basis for scoring.
erasures, hair, ears, eyes, eyebrow, eyelash, pupil, dot for eye, "empty" eye, nose, teeth, neck, arms, arms rigid at sides, hands, fingers, feet, clothing |
| (26) Sex: | Drawing a figure of the same sex first. |

Raw score data were transformed into percentages for purposes of analysis.

Case History.--Case histories were obtained for all Ss in the study.

Information for these came from parents (principally mothers) and school records for the EMH and normal children, and from the case histories at Lincoln State School for institutionalized retardates. A sample case history form is included in the Appendix. The major parts of the history dealt with:

- (1) The family. Information about the constituent members, their ages, education, occupation, health and mental status was recorded.
- (2) The home. Whether the home is owned or rented by the family, amount of income in the home, and rated "class status" were considered the most important variables in analysis. Eight income

levels were delineated, with \$1500 as the income interval selected. Being on relief constituted the lowest income bracket and \$10,000 or more per year was selected as the highest bracket.

A modification of Hollingshead's (1958) system for rating class-status was used to stratify families. Since no families described as "upper class" were included, only six classifications were actually used. These were, lower-lower, middle-lower, upper-lower, lower-middle, middle-middle and upper-middle classifications. There was 80% agreement between the two investigators on classification of 30 homes.

(3) Neighborhood culture groups. Since data for only EMH and normal groups were available for this category of the history, only neighborhood racial composition factors were included for analysis. The specific culture groupings were selected because they were the only ones encountered. They included white, colored, mixed colored and white, and mixed "Italian and other white" groups.

Other neighborhood variables, such as recreational outlets, number of children of same age as S, and the like, were either so diverse or so ineffectively reported by parents that they were not included in the data analysis.

(4) Developmental history of the child. This section of the history included data about pregnancy (term of, attitudes of parents toward, mother's condition, and the like), delivery (hours in labor, where born, who attended, attitudes towards, child's health, weight, and the like), history of feeding, locomotion, handedness, toilet training, speech development, illnesses, sexual development, peer adjustment and

school adjustment. These categories provided the data reported in Table 6.

The histories were obtained by two research assistants experienced in obtaining case histories. At the time of the study, Mrs. Sylvia Mark, a graduate student in psychology and a registered nurse, had for twelve years collected case histories for hospital records and private physicians. Mrs. Emma Fritchett, a graduate student in speech pathology, had served as a teacher and guidance advisor to children for over fifteen years and in these capacities had collected many formal case histories. Both assistants were given orientation training in the history used in this study, together with specific help in obtaining information for parents of retarded children. Role-playing was used during this training.

No pre-determined criteria were employed for selection of particular cases for the assistants. Families were contacted and information obtained in terms of convenience to the interviewers. Approximately one and one-half to two hours were necessary for each interview, plus another one-half hour for recording data in the history form after completion of the interview. Interviews with school teachers took from fifteen to twenty minutes each and investigation of school records for each child ordinarily involved about the same amount of time.

It is the opinion of the principal investigators that the information obtained by this method can be considered to be reliably interpreted, from parents' reports and the records of the interviewers. Reliability of the reports of the parents with respect to discrete data could not be determined, of course, but the interviewers felt they were able to obtain reasonably accurate reports from their informants.

Vineland Social Maturity Scale.--This scale has been described fully by Sill (1934). It was used in this study to obtain information about the social development and behavior of $\bar{J}$ s. Data for the scale were obtained during the case history interviews with the parents. Consequently scores for only EMH and normal children are available for analysis.

Measures of School Adjustment

While some information was obtained from the case history with respect to each $\bar{J}$'s behavior in school and attitudes towards school, two types of inventories were used to obtain the major data in this area. One was a clinical interview designed to obtain the child's verbal reactions to various aspects of school. It is based on a previous investigation (Malpass, 1932). The other inventory was designed to get teacher-ratings of a child's behavior. The teacher's rating scale included in this study is a modification of one devised at the University of Illinois Bureau for Exceptional Children and found to be useful in working with teachers of both retarded and normal children. Samples of these two instruments are included in the Appendix.

The clinical interview consisted of an individual structured interview of each $\bar{J}$ from the EMH and normal groups. After establishing rapport, $\bar{J}$ made a general request for information about $\bar{J}$'s attitudes towards school. This was supplemented by additional questions or statements designed to elicit maximum information relevant to the child's reactions to various aspects of school. Five areas about school were selected for investigation. They are listed below with the

general and representative supplementary questions asked about them.

(1) School in general - "Tell me something about your school." Supplementary: "Can you tell me more about it?" "How do you feel about school?" "What does school mean to you?"

(2) Teachers - "Tell me something about your teacher." Supplementary: "Can you tell me more about your teacher?" "How do you feel about your teacher?" "How does your teacher treat you?"

(3) Academic achievement - General: "Tell me something about your school work." Supplementary: "Can you tell me more about your school work." "How do you feel about your academic work?" In addition, open-ended questions about grades and, where advisable, about specific course content material, were included.

(4) Peers - General: "Tell me something about the kids in your class--how do you feel about them?" If no reference to boys or girls from girls were spontaneously given, I then said, "Well, how about the boys (girls)--tell me something about them." If, as sometimes happened, a particular child was emphasized, I inquired about and recorded responses about "other boys (girls)" as well.

(5) Discipline - General: "How do the kids in your school behave, in general? Tell me something about that." Supplemental: "What does the teacher do when the kids do things they are not supposed to?" "How does she treat you when things are going well?" If specific children or incidents were selected for report by I, I inquired about more general aspects of discipline.

The interview was scored by using a manual developed during the early stages of the study. It is based on a rationale developed by Seligson and Tyler (1978). A seven point rating scale (from 0-6) pro-

vides indices for evaluating responses to each area of school discussed by the child. Examples of response-categories for the scale were obtained by interviewing two classes of nine EM children and twenty-eight normal children, respectively. Reliability coefficient for three inter-judge ratings were .87, .93 and .94. Two judges scored all interviews from which data were analyzed for this study.

The teacher's rating scale is a modification of a scale originally devised by Drs. Samuel Kirk and James Gallagher at the University of Illinois. In a pilot study conducted by Henry Hinton, a research assistant, in the Spring and Summer, 1957, it was found that four different teachers (two experienced teachers and two student teachers) rated children on this scale very similarly. Reliabilities ranged from .64 to .94, with the median being .86. Thus it was felt that teacher ratings on this study can be presumed to be representative of how other teachers would rate the children. Ratings were made by checking a point on a graphic scale. Teachers were told there were seven units on the scale and they were requested to mark either on the four vertical stubs marking each alternative-statement or near the middle of the interval between the stubs. (See Teacher Rating Scale, Appendix).

The clinical interview ratings (B-6) were based on perhaps several statements made by the J regarding each of the aspects of school in question, while the ratings of the teacher (B-6) were based on eighteen relatively specific behavior descriptions. Since not all inter-relationships were of interest to the investigators, data reported in Table 11 refers only to those relationships which were determined to be of significance to the study. These were determined beforehand.

Health Status Measure

A standard clinical health examination was conducted by Homer E. Hanson, M.D., Diplomate in Pediatrics, for all IHH children. It was not possible to obtain comparable ratings on the control group nor for the institutional group. The examination was to include a neurological examination if the pediatrician felt such an examination would reveal neurological defect. None of the children were so rated, however, so no neurological examinations were administered. The form used for the physical examination is given in the Appendix.

Treatment of Data

The foregoing description of the separate measures indicates the scoring procedures used for each of the instruments. When the data were all scored, tabulations were made and re-checked. Data available for correlational analysis were then key-punched on IBM cards and fed into an IBM 650 computer. All computation were made by the IBM 650 computer at the Southern Illinois University Computing Service.

As stated earlier, exact matching of retarded and normal children was not possible. Therefore, differences between retarded children and normals and between IHH and institutionalized children were estimated by means of the t -test for independent samples. This statistic was used because it gives a more conservative estimate of possible differences.

Case history data and Draw-A-Person data were analyzed in terms

of percentage scores, since the nature of these data did not permit correlational analysis. Health examination data was analyzed as raw scores.

Data relative to Hypothesis II and its corollaries were initially related to each other by means of product-moment correlations. Since age was not controlled for on the measures, except in the case of the intelligence measures and the Vineland Social Maturity Scale, this variable was accounted for by means of partial correlation coefficients. In reporting results, partial r s were used. (See Chapter III).

CHAPTER III

RESULTS

Results for this part of the study have been arranged and analyzed in two major sections. Section 1 deals with comparisons of major groups leading to differences between and within them indicated by the clinical measures. Section 2 deals with intercorrelations of the various instruments used in the part of the study. Comparisons were made between the three major population samples, IDH retarded, institutional retarded and normal, and within each according to sex.

Section 1

Comparisons of Retarded and Normal Children on Intellectual, Personal-Social, School, and Health Measures

Measures of Intellectual Ability

Intelligence.--The means and standard deviations for all retarded children as measured by the WISC, and for all normal children as measured by the CTNN, are provided in Table 2. All retarded children fell in the general IQ range of the "educable mentally handicapped" in the state of Illinois with the mean score for the total group falling at 65.29 (standard deviation 8.64 points), with no significant differences between sex groupings. The normals had a mean IQ of 110.55 (standard deviation 15.52 points), with no significant difference in mean IQs between boys and girls. The mean IQ for the normal group is at the upper end of the "average" range of intelligence, as measured by the

CTSM. This sampling factor occurred because age, sex, and community locale were considered the most crucial matching variables and the "normal" children, so long as their IQ was five points above the EMH criterion (IQ 75, State of Illinois), were included primarily on these bases.

Table 2 gives the means and SD's for the major groupings (normals, all retardates, and the sub-groups of retardates) on the IQ tests used in the study. The F -ratios between these groups indicate a highly significant difference between the total retardates group and normals. The EMH total group mean is also significantly higher (.01 level) than the institutionalized group mean. In spite of an attempt to equate the two retarded sub-groups in terms of IQ status, it was not possible to do so. This was due to the difficulty in finding a large enough sample of institutionalized retardates in the educable-mentally-handicapped IQ range. Although the Lincoln (Illinois) State School is the largest institution for retardates in this country, there were too few boys and girls with IQs in the upper 60's and 70's to permit a more equitable matching with the EMH group.

Apparently most of the mean IQ difference between the retarded groups is due to the differences between boys' IQs. Table 2 reveals a significant difference between the scores of EMH and institutionalized boys. The IQ difference between the girls' groups only approaches significance.

There were no significant sex differences for any of the major groups studied, although the boys in all groups had slightly higher IQs than the girls. When these sex differences were noted by preliminary inspection, EMH teachers and supervisors and personnel at Lincoln State

TABLE 2

DIFFERENCES BETWEEN MAJOR POPULATION SAMPLES ON IQ TESTS¹

Group	N	MM	SD	t-RATIO
Normals	71	110.54	15.52)	
Retardates	113	65.29	8.64)	25.391**
EDH Retards	56	67.80	8.94)	
Lincoln Retards	57	62.82	7.64)	3.183**
Male Normals	45	111.02	14.90)	
Female Normals	26	109.04	16.82)	.515
EDH Male Retards	40	68.67	9.26)	
EDH Female Retards	16	67.62	7.92)	1.156
Lincoln Males	34	63.76	7.82	
Lincoln Females	23	61.44	7.32	.937
EDH Males	40	68.67	9.26)	
Lincoln Males	34	63.76	7.82)	2.437*
EDH Females	16	65.62	7.92)	
Lincoln Females	23	61.43	7.32)	1.701

¹Normal IQs based on CTMH scores; retarded IQs based on WISC scores

** significant at .01 level

* significant at .05 level

School were asked their opinions about this. In each case the answer given was that girls in our society tend to be more docile, conforming, less overtly troublesome. Consequently we presume girls are less likely to be selected for either EMI classes or for institutions. Certainly, it would not be expected that more than twice as many boys as girls (Ns 35, and 13, respectively) would be selected for EMI classes on a sex-IQ difference alone. Obviously a spurious factor operates so that more boys than girls are selected for EMI placement and which contributes to the tendency for the retarded boys to have higher IQs than the retarded girls.

Progressive Matrices Test.--Results from Table 3 indicate that the most recent edition of the Matrices discriminates between retarded and normal qs in the age group used for this part of study (CA 8-0 years to 13 years 11 months). The normals had a mean score 10 points above that of the retards, with slightly greater variation in scores. This difference was highly significant (.001 level). Differences in PM scores of the total EMI and institutional groups approached the .05 level of significance, however, with the former group's mean being about 1.5 points higher than the institutional group's mean.

There were no sex differences within any group although, as with IQ scores, boys in each group had a slightly higher mean score. As with IQ scores, the EMI boys' mean PM scores were slightly higher than those of their institutionalized counterparts, but not significantly so. The mean scores for both groups of female retards were quite similar.

Discussion of the possible use of the PM as a short-form measure of intellectual ability is made in Section 2 of this Chapter, where intercorrelations between the PM and other measures are presented.

TABLE 3

DIFFERENCES BETWEEN MAJOR POPULATION SAMPLES ON PROGRESSIVE MATRICES

Group	N	MM	SD	t-ratio
Normals	67	27.93	5.47)	
Retardates	104	17.55	4.46)	13.641**
EDH Retards	48	18.35	4.21	
Lincoln Retards	56	16.88	4.56	1.708
Male Normals	44	28.09	5.29)	
Female Normals	23	27.70	5.92)	.279
EDH Male Retards	35	18.86	4.40)	
EDH Female Retards	13	17.00	3.78)	1.370
Lincoln Males	33	16.85	5.43)	
Lincoln Females	23	16.48	2.93)	.297
EDH Males	35	18.86	4.30)	
Lincoln Males	33	16.85	5.43)	1.700
EDH Females	13	17.00	3.78)	
Lincoln Females	23	16.48	2.93)	.460

** significant at .01 level

Measures of Personal-Social Behaviors

All the measures used to investigate the personal-social behaviors selected for this study discriminate retarded from normal children. In contrast to the normals, the retards as a group demonstrated a lower level of motor proficiency; gave more self-reports indicative of fears and "anxiety"; demonstrated more "deviant" signs on their human figure drawings; were rated by case history interviewers to come from different types of family and neighborhood backgrounds, and to have a greater number of deviant developmental characteristics; and, specifically for the EDH group, received lower ratings on a measure of social maturity. More specific analyses of data are included below.

Oseretsky Motor Development Scale.--Responses to the items making up this test yielded raw score data used for analysis of results. Table 4 demonstrates that retarded children received significantly lower scores (.001 level) than did the normal group (means of 72.79 vs 108.76, respectively). Their scores were also somewhat more variable, indicating a wider distribution of scores for this group. These findings corroborate those reported by Sloan (1951b) and Labin (1957), although these investigators compared only institutionalized retardates with normal ss.

When the EDH and Lincoln State School groups were compared, the EDH mean scores were nine points higher than the Lincoln group. This difference, however, is not significant at the .05 level. Similar differences, neither of which is significant, occur when scores of boys and girls in the two retarded groups are compared. In each case, EDH children scored higher than their corresponding group of institutionalized retardates. No significant differences were found between mean scores of boys and girls in either retarded group, although, in contrast

TABLE 4

DIFFERENCES BETWEEN MAJOR POPULATION SAMPLES ON
OSERETSKY MOTOR DEVELOPMENT SCALE

Group	N	MM	SD	t-ratio
Normals	68	108.76	19.10)	9.838**
Retardates	103	72.79	25.84)	
EMH Retards	47	77.85	26.19)	1.838
Lincoln Retards	56	68.55	24.99)	
Male Normals	44	107.89	20.62)	.511
Female Normals	24	110.38	16.25)	
EMH Male Retards	34	78.06	25.31)	.087
EMH Female Retards	13	77.31	29.41)	
Lincoln Males	33	67.91	29.14)	.229
Lincoln Females	23	69.48	18.06)	
EMH Males	34	78.06	25.33)	1.650
Lincoln Males	33	67.07	29.14)	
EMH Females	13	77.31	29.41)	.992
Lincoln Females	23	69.48	18.07)	

** significant at .01 level

to the IQ measure, the normal girls' mean motor proficiency score was higher than the boys' score; this was probably due to sampling factors and does not represent a "true" sex difference in motor proficiency.

Children's Manifest Anxiety Scale.--McCandless *et al.* (1964), have reported that CMAS responses of public school children are inversely related to IQ, so mean score differences between the normal and retarded groups were expected. However, the differences obtained were so great (means of 24.02 for retards vs 13.74 for normals) that they suggest the retards report considerably more self-concerns than normal children. It does not seem probable that differences of this magnitude can be explained merely in terms of differential administration of the CMAS (retards had the statements read to them; normals read and answered their own protocols), nor to a stereotypy effect in retards due to dichotomous nature of the responses, since all retards were asked either to give examples or to explain their responses every 7-10 questions. Rather, it is our opinion that the obtained results reflect a very marked tendency on the part of both groups of retarded children to report more fears and "anxieties" than their normal counterparts. Data about the CMAS are presented in Table 5.

Although no ratings of these specific characteristics measured by the CMAS were obtained from parents or attendants, data from the case history (see Table 4) and Social Maturity Scale (see Table 8) suggest that the CMAS self-reports correspond with the behaviors of retards as reported by their parents.

The CMAS also differentiates the EMH group from state school children (mean scores of 21.48 and 23.98, respectively, with almost identical standard deviations). The difference is highly significant

TABLE 3

DIFFERENCES BETWEEN MAJOR POPULATION SAMPLES ON
CHILDREN'S HANFEST ANXIETY SCALE

Group	N	ME	SD	t-value
Normal	63	13.75	6.21)	
Retardates	94	24.02	7.50)	8.833**
EMH Retards	41	21.69	7.24)	
Lincoln Retards	13	25.98	7.31)	2.963**
Male Normal	39	13.85	6.50)	
Female Normal	24	13.59	5.61)	.162
EMH Male Retards	31	20.19	6.83)	
EMH Female Retards	10	25.50	7.31)	2.010*
Lincoln Males	12	25.75	7.24)	
Lincoln Females	21	26.33	7.54)	.290
EMH Males	31	20.19	6.83)	
Lincoln Males	12	25.75	7.24)	3.124**
EMH Females	10	25.50	7.31)	
Lincoln Females	21	26.33	7.54)	.290

** significant at .01 level

* significant at .05 level

and suggests that institutionalized retarded children (in the age range covered by this study) probably indicate more worries and fears than their non-institutionalized retarded counterparts who live at home.

That these differences are due primarily to differences among retarded boys is reflected in the sex-group comparisons reported in Table 5. Although there is no marked difference in mean scores between the EMH and Lincoln girls, there is a highly significant difference between the means of the EMH and Lincoln boys, in favor of the former. The EMH boys also reported significantly fewer fears and worries than the EMH girls but there was no difference between sexes for the Lincoln group.

It is interesting that the mean scores and standard deviations of the normal boys and girls are practically identical, so a "general sex factor" probably was not operating to bring about the differences within the retarded groups. Rather, it might be that the observed differences in favor of the EMH boys are due either to an attempt of these boys to give more socially-acceptable answers than did their female counterparts, or to a real difference in self-report to "anxiety-loaded" questions.

Case History.--Data about the families, homes, neighborhoods and general cultural backgrounds, and developmental histories are included in Table 6. These data are based on variable H's because information for every category was not available for all Ss. Analysis of the data was made in terms of percentages because in many categories a small N in the institutional group precluded comparison of this group with the EMH retards. Because EMH and institutionalized children tend to resemble each other in most of the categories, discussion will be

TABLE 6

CASE HISTORY INFORMATION ABOUT IRR AND INSTITUTIONAL

RETARDED AND NORMAL CHILDREN

Category	IRR		Institutional		Total Retards		Normals	
	N	%	N	%	N	%	N	%
I. Family								
Mother:								
Living	43	.857	43	.90	90	.827	69	.983
Deceased	2	.042	3	.06	7	.072	1	.014
Totals	45		46		97		70	
Age:								
20-24	0	.00	0	.00	0	.00	2	.028
25-29	1	.022	2	.04	3	.038	5	.072
30-34	11	.25	11	.23	22	.282**	11	.159
35-39	8	.181	3	.06	13	.166	21	.304
40-44	13	.289	8	.17	21	.269	19	.273
45-49	9	.201	8	.17	17	.217**	6	.086
50-54	2	.045	0	.00	2	.025	3	.042
55-59	0	.00	0	.00	0	.00	0	.00
60+	0	.00	0	.00	0	.00	0	.00
Totals	44		34		78		68	
Education								
0-4	11	.244	10	.23	21	.28*	0	.00
5-8	23	.511	10	.23	33	.44**	19	.275
9-10	6	.132	4	.11	10	.133**	3	.043
11-12	3	.066	6	.17	9	.120*	25	.362
13-14	1	.022	0	.00	1	.013**	10	.144
15-16	1	.022	0	.00	1	.013**	8	.115
17+	0	.00	0	.00	0	.00	3	.043
Totals	45		20		73		68	
Home								
Unskilled	29	.644	17	.45	46	.688**	48	.695
Skilled	2	.044	3	.15	5	.079	3	.043
Professional	1	.022	0	.00	1	.013*	12	.173
Totals	42		20		63		63	
Father:								
Living	42	.954	39	.812	81	.88	63	.913
Deceased	2	.045	9	.187	11	.119	6	.086
Totals	44		48		92		69	

1Significant tests refer to comparisons between groups of total retards and normals. *---.05 level of significance **---.01 level of significance

GROUP 6 (Continued)

Category	EMH		Disinclination		Total		Males	
	N	%	N	%	N	%	N	%
Age								
20-24	0	.00	0	.00	0	.00	0	.00
25-29	0	.00	1	.041	1	.013	0	.00
30-34	3	.073	2	.083	5	.079	6	.083
35-39	4	.133	4	.166	10	.133	12	.19
40-44	6	.190	6	.25	12	.167	18	.283
45-49	3	.123	0	.00	3	.079**	13	.206
50-54	0	.00	3	.123	13	.203	0	.00
55-59	3	.123	3	.123	10	.083**	3	.047
60+	7	.173	1	.041	8	.123	3	.047
Total	40		24		64		63	
Education								
0-4	11	.268	6	.25	17	.263**	3	.079
5-8	22	.336	14	.608	36	.562*	9	.142
9-10	3	.121	0	.00	3	.079	6	.093
11-12	1	.024	2	.086	3	.046*	18	.30
13-14	1	.024	0	.00	1	.013	6	.093
15-16	1	.024	0	.00	1	.013	3	.079
#	0	.000	1	.043	1	.013*	13	.206
Total	41		23		64		63	
Employed	17	.406	1	.043	18	.281*	3	.043
Unskilled	13	.357	13	.601	26	.466*	6	.093
Skilled	10	.238	4	.181	14	.218*	40	.643
Managerial and Professional	0	.00	2	.09	2	.031*	13	.209
Total	42		22		64		62	
Marital Status:								
Married	37	.787	23	.62	60	.714	62	.883
Divorced	6	.127	10	.27	16	.190**	6	.083
Separated	4	.083	3	.08	7	.083	0	.000
Re-married	3	.106	1	.03	6	.071	3	.071
Siblings:								
0	3	.063	2	.05	5	.058**	13	.183
1-2	13	.319	12	.31	27	.313**	35	.50
3-5	14	.297	16	.41	30	.348	16	.218
6-9	13	.276	5	.13	18	.209**	4	.057
9+	2	.042	4	.10	6	.069	2	.028
Total	47		39		86		70	
First	13	.319	5	.13	20	.238	22	.314
Middle	18	.382	9	.23	27	.302	18	.251
Last	11	.234	5	.13	16	.238	17	.242
Only	3	.063	1	.03	4	.059**	13	.186
Total	47		20		67		70	
Mental Defectives in Family:								
Mother	1	.021	13	.65	0	.00	0	.00
Father	0	.00	5	.20	0	.00	0	.00
Siblings	12	.255	15	.73	0	.00	2	.031
Other	3	.063	1	.03	0	.00	1	.013
None	31	.659	0	.00	0	.00	0	.00

TABLE 6 (continued)

Category	Institutionalized		Total		Retards		Normals	
	N	%	N	%	N	%	N	%
Institutionalized family members:								
Mother	0	.00	7	.304	0	.00	0	.00
Father	0	.00	7	.304	0	.00	0	.00
Siblings	1	.021	13	.512	0	.00	2	.051
Other	1	.021	0	.00	0	.00	3	.044
None	45	.944	0	.00	0	.00	0	.00
Totals	47		27		0		55	
2. Home Characteristics								
Home:								
Own	20	.426	2	.074	22	.392*	30	.82
Rent	26	.553	8	.296	34	.607*	12	.171
Totals	46		10		56		70	
Class:								
Lower-lower	29	.617	23	.815	52	.929*	9	.128
Middle-lower	6	.127	3	.107	9	.161	4	.057
Upper-lower	7	.148	1	.035	8	.143	3	.042
Lower-middle	4	.085	2	.070	7	.125*	19	.271
Middle-middle	1	.021	1	.035	2	.036*	34	.485
Upper-middle	0	.00	2	.070	2	.036	1	.014
Totals	47		22		80		70	
Income:								
Relief	21	.434	5	.179	26	.459*	8	.115
0-2,000	12	.255	11	.386	23	.414*	5	.072
2,100-3,500	7	.148	8	.286	15	.268	9	.130
3,600-5,000	7	.148	2	.070	10	.179	13	.188
5,100-6,500	1	.021	0	.00	1	.018*	15	.217
6,600-8,000	0	.00	1	.035	1	.018*	9	.13
8,100-10,000	0	.00	0	.00	0	.00**	6	.086
10,000+	0	.00	0	.00	0	.00*	5	.072
Totals	46		26		74		69	
3. Neighborhood Culture								
Mixed White								
Nationalities	26	.576* ²	No	Data			62	.885
Colored and White	1	.022	"	"			5	.071
White	2	.044	"	"			0	.00
Primarily Italian	8	.177	"	"			3	.042
Totals	45						70	
4. Developmental History								
Planned Pregnancy:								
Yes	6	.146	6	.22	12	.176*	26	.433
No	35	.853	21	.77	56	.823*	34	.566
Totals	41		27		68		60	
Sex Preference of Parents:								
None	33	.785	19	.827	52	.80*	31	.525
Yes Male and								
Female	9	.214	4	.173	13	.20*	28	.474
Totals	42		23		65		59	

²Comparisons between EMI and normal groups only

Table 6 (Continued)

Category	DHB		Institutional		Total Records		Totals	
	N	%	N	%	N	%	N	%
Mother's condition								
During Pregnancy:								
Morning sickness	16	.36	0	.00	16	.28**	27	.45
Fatigue	7	.16	3	.10	10	.17**	3	.05
Illness	3	.07	2	.07	5	.08**	6	.10
Weak	3	.07	3	.10	6	.10*	7	.11
Anxious	1	.02	0	.00	1	.02	1	.02
Reported nothing	13	.29	0	.00	0	.00	14	.24
Totals	47		10		17		60	
Mother:								
Child wanted	23	.47	3	.17	26	.44*	62	.93
Child not wanted	19	.41	14	.82	23	.39**	3	.04
Father:								
Child wanted	23	.47	3	.17	26	.44*	60	.92
Child not wanted	19	.41	14	.82	23	.39**	4	.06
Totals	42		17		19		66	
Length of Pregnancy:								
Full term	34	.77	30	.86	64	.90**	62	.93
Premature	10	.23	6	.17	16	.23**	3	.04
Totals	44		36		82		65	
Previous Pregnancy:								
Live Births								
Miscarriage								
Section	1	.04	1	.04	2	.04	3	.04
Stillborn	0	.00	1	.04			0	.00
Totals	10		22		41		63	
Time Labor:								
0-2	14	.43	4	.26	18	.38**	9	.13
3-4	7	.21	3	.20	10	.21	7	.12
5-6	3	.09	4	.26	7	.14	12	.18
7-8	2	.06	0	.00	2	.04	6	.10
9-10	0	.00	2	.13	2	.04	3	.05
11-12	3	.09	1	.06	4	.08	8	.12
/	3	.09	1	.06	4	.08	10	.18
Totals	32		15		47		55	
Place of Birth:								
Hospital	21	.46	(22	1.00)	43	.64	51	.79
Home	24	.53	(from large		24	.35	13	.20
			(city					
Other	0	.00	0	.00	0	.00	0	.00
Totals	45		22		67		64	
Attendant at Delivery:								
Physician	41	.93	25	1.00	66	.97	63	.96
Midwife	2	.04	0	.00	2	.02	2	.03
Other	0	.00	0	.00	0	.00	0	.00
Totals	43		25		68		65	

TABLE 6 (Continued)

Category	N		Percentage		Total		Female	
	N	%	N	%	N	%	N	%
Chronic illness in family:								
Mother	13	.312	6	.313	21	.32*	1	.026
Father	13	.312	12	.631	27	.60*	8	.133
Siblings	7	.043	1	.052	8	.12	3	.044
Other	8	.084	8	.08	9	.08	14	.208
Totals	41		26		67		26	
Attitude towards delivery:								
Mother favorable	8	.203	3	.10	13	.263*	30	.701
Mother unfavorable	31	.792	3	.90	36	.73*	14	.213
Father favorable	7	.233	4	.50	11	.289*	47	.824
Father unfavorable	23	.767	4	.50	27	.71*	10	.173
Totals Mother	39		10		49		64	
Totals Father	30		8		38		11	
Child's health at birth:								
Good	30	.714	8	.80	38	.73**	19	.921
Poor	12	.287	2	.20	14	.269*	3	.078
Totals	42		10		52		22	
Instruments used in delivery:								
Yes	7	.20	4	.285	11	.224	13	.263
No	25	.80	10	.714	35	.773	42	.736
Totals	32		14		46		55	
Anesthesia for delivery:								
Yes	16	.432	3	.272	19	.393	36	.60
No	21	.567	8	.727	29	.604	24	.40
Totals	37		11		48		60	
Birth weight:								
0-5 pounds	7	.179	9	.321	16	.238*	3	.048
6-7 "	13	.304	14	.50	29	.432	30	.483
8-9 "	14	.336	4	.142	18	.268	22	.354
9+	3	.076	1	.035	4	.059	7	.112
Totals	37		28		67		62	
Post-natal feedings:								
Schedule	13	.342	2	1.00	15	.376	33	.533
Self Demand	25	.656	0	.00	25	.623	28	.444
Totals	38		2		40		61	
Breast	9	.239	2	.086	11	.171	17	.257
Bottle	31	.756	19	.816	50	.781**	37	.56
Breast & Bottle	1	.024	2	.086	3	.046	12	.181
Totals	41		23		64		66	
Age of weaning:								
5- 6 Months	0	.00	0	.00	0	.00	2	.034
7- 8 "	0	.00	2	.153	2	.040	2	.034
9-10 "	3	.084	3	.230	6	.121	11	.186
11-12 "	13	.361	2	.153	15	.306	21	.333
13-15 "	7	.194	2	.153	9	.183	11	.186
16-20 "	2	.053	2	.153	4	.081	4	.067
21+	11	.305	2	.153	13	.265	8	.133
Totals	36		13		49		59	

TABLE 6 (Continued)

Category	Institutional		Total Retards		Normals	
	N	%	N	%	N	%
Sex:						
Balanced	28	.431	No	Data	34	.531
Unbalanced	15	.348	"	"	30	.448
Totals	43				64	
Age Crawling Began:						
3- 6 Months	4	.23	No	Data	6	.142
7- 8 "	4	.23	"	"	20	.478
9-10 "	4	.23	"	"	8	.19
11-12 "	3	.187	"	"	0	.00
12+ "	1	.042	"	"	0	.00
Did not creep	0	.00			8	.19
Totals	16				42	
Age Walking Began:						
8-10 Months	3	.096	0	.00	3	.054*
11-12 "	9	.29	4	.166	13	.236*
14-16 "	2	.064	7	.291	9	.163
17-19 "	7	.223	4	.166	11	.200
20-22 "	1	.032	0	.00	1	.018
23-25 "	4	.129	4	.166	8	.143*
26+ "	5	.161	5	.208	10	.181*
Totals	31		24		55	
Handedness:						
Left	7	.162	No	Data	6	.088
Right	24	.837	"	"	60	.882
Both	0	.00	"	"	2	.029
Totals	31				68	
Defecation Training Completed:						
-10 Months	0	.00	0	.00	0	.00
11-12 "	1	.033	0	.00	1	.023*
13-15 "	5	.178	2	.142	7	.166
16-18 "	4	.142	0	.00	4	.093*
19-21 "	0	.00	0	.00	0	.00
22-24 "	6	.214	2	.142	8	.19*
25+ "	12	.428	10	.714	22	.523**
Totals	28		14		42	
Urinary Training Completed						
-10 Months	0	.00	0	.00	0	.00
11-12 "	2	.076	0	.00	2	.052
13-15 "	1	.038	1	.083	2	.052
16-18 "	3	.115	0	.00	3	.078**
19-21 "	0	.00	00	.00	0	.00
22-24 "	8	.307	2	.166	10	.263)**
25+ "	12	.461	9	.75	21	.552)
Totals	26		12		38	
Cathartics Used:						
Yes	8	.296	No	Data	9	.29
No	10	.703	"	"	22	.71
Totals	27				31	

TABLE 6 (Continued)

Category	Institutional		Total		Total		Total	
	N	%	N	%	N	%	N	%
Age First Words Spoken:								
8-10 Months	1	.062	0	.00	1	.052	No Data	
11-12 "	3	.187	0	.00	3	.157	"	"
13-14 "	2	.125	0	.00	2	.105	"	"
15-18 "	3	.187	0	.00	3	.157	"	"
19+	7	.437	3	1.00	10	.326	"	"
Totals	16		3		19			
Age First Phrases:								
12-13 Months	0	.00	0	.00	0	.00	7	.304
16-18 "	0	.00	2	.157	2	.076**	9	.391
19-21 "	0	.00	0	.00	0	.00	1	.043
22-24 "	7	.538	4	.307	11	.423**	4	.173
25 + "	6	.461	7	.538	13	.50*	2	.086
Totals	13		13		26		23	
Age Physical Signs First Noted:								
8-10	1	.027	No Data				3	.049
11	4	.111	"	"			8	.131
12	1	.027	"	"			7	.114
13	2	.055	"	"			1	.016
14	2	.055	"	"			1	.016
15	0	.00	"	"			0	.00
16	3	.083	"	"			6	.098
17 (None)	23	.638	"	"			35	.573
Totals	36						61	
3. Leisure Reading of Child:								
None	40	.869*	No Data				4	.057
Very little	6	.130**	"	"			29	.414
Moderate	0	.00					11	.157
Lots	0	.00					26	.371
Totals	46						70	
Attitudes toward School:								
(from Mother)								
Strongly likes	2	.048**	No Data				15	.214
Likes	31	.756	"	"			30	.714
Dislikes	7	.170**	"	"			4	.057
Strongly Dislikes	1	.024	"	"			1	.014
Totals	41						70	
Parent's estimate of child's Intelligence:								
Superior	0	.00	No Data				6	.085
Bright	1	.021*	"	"			39	.557
Average	10	.212	"	"			21	.300
Slow	29	.617*	"	"			3	.042
Very Slow	7	.148	"	"			1	.014
Totals	47						70	

principally in terms of comparing the total retarded group to normals.

Family Characteristics.--There are several striking differences in family characteristics of the retarded and normal groups. Although there seems to be no age difference in mothers, there is a much higher percentage of fathers over age 30 of retarded children than of normals (47% vs. 23%). As far as parents' education is concerned, almost three-fourths of the retardates' mothers and 83% of the fathers finished eight or fewer years and only 3.4% had more than a high school education. In contrast, approximately one-fourth of the normal children's fathers and mothers had only elementary school educations, while 30% of mothers and 34% of fathers had at least some college training.

Similar types of differences between parent groups exist in terms of occupational classification. Only 3% of retardates' mothers and 23% of their fathers were reported to be engaged in skilled or professional work, and 47% of these fathers were reported, instead, to be unskilled workers. Correspondingly, 25% of the mothers of control children and 83% of their fathers engage in skilled or professional work, and only 10% engage in unskilled work. Whereas 28% of retardates' fathers were unemployed at the time of this study, only 5% of the controls' fathers were out of work then.

Families of the retarded children tend to be larger than those of their controls. For example, there were three times as many "only children" in the control group, and 50% of children in this group had only one sibling. Less than one-third of the normal children came from families with as many as four children. Conversely, 62% of the retardates came from families with four or more children and 28% came from those with seven or more children. Comparison of ordinal position

did not reveal any striking differences between the groups, except for the "only child" consideration.

Marriages seem to be somewhat more stable in the control group families than in the retardates' families. Only 12% of the control children came from "broken homes" while 28% of the retarded children's parents were either divorced or separated.

Other family characteristics included in this portion of the study included the presence of mental defect in, and institutionalization of, family members. Only 20% of fathers, but 65% of mothers and 75% of siblings, of institutionalized retardates (for whom this information was available) were considered defective, and 25% of the EMH sample had defective siblings. Of the included sample of institutionalized defectives, 30% had parents who were themselves institutionalized, and 65% had institutionalized siblings. However, no parents and only 2% of siblings of EMH children were reported to be institutionalized. None of the parents of control children was considered defective and only 3% of this group had defective siblings, all of whom were institutionalized.

Home Characteristics.--Although it was the intention of the study to match retardates and controls on socio-economic background variables, this was a less crucial issue than age and sex variables. Results of the ratings of social-class of the homes reveal that there is a distinct difference between the types of homes of retardates and normals. Approximately 77% of retardates but only 22% of normals came from rated lower class homes. Conversely, only 23% of the retardates' but 78% of normals came from middle-class homes. Approximately 35% of retardates' families, but only 12% of normals' families were on

relief. Of retardates' families, 51% reported incomes of less than \$3,6000 per year, while only 20% of normals' families were so categorized. On the other hand, only 3% of retardates' families but 50% of normals' families reported annual incomes of \$5,000 or more.

Similar differences between groups are found in terms of variables related to home ownership. Only 39% of retardates' families own their homes, while 80% of the normals' families do. Although tabular data was not prepared, the case investigators reported that the EMH retardates' families had fewer luxury possessions in the home (automatic washers and dryers, TV sets and the like) and that, in general, home furnishings were of inferior quality to those in homes of normal children.

Neighborhood Culture Groups.--The data suggest that a slightly lower proportion of EMH retarded children than control children came from "mixed white" (various European extraction groups, excepting primarily Italian) and "mixed white-colored" neighborhoods. A significantly larger proportion of retardates came from "mixed Italian" neighborhoods. This may have been a direct function of sample restriction to the Southern Illinois area, rather than reflecting true racial-cultural differences. Retarded children came from neighborhoods which had fewer public and private recreational facilities, excepting school grounds, and such facilities tended to be inferior in rated quality to those in control children's neighborhoods.

Developmental Factors.--

A. Pregnancy: From information available, significant differences occur in the developmental histories of retarded children and their normal controls. Table 6, section 4, indicates that only 15% of retardates but 43% of controls were planned. This may be related

to economic, educational and intellectual differences between parents of the retardates and those of the control group. Eighty percent of retardates' parents but only 52% of the controls' parents reported a sex preference prior to birth of their children.

Another striking difference between the groups was that approximately 56% of retardates' parents reported they did not want the child prior to birth while only 5% of the controls' parents so reported. There were no differences between groups in terms of reported previous miscarriages or Caesarian section births.

There were some significant differences in terms of reported maternal illness, working or accidents during pregnancy. For example, 17% more control than retardates' parents reported temporary illness (mostly nausea), while 16% more retardates' parents reported fatigue during this time. But 31% of retardates' mothers reported chronic illness while only 1% of control mothers did so. Only 80% of the retarded group but 95% of the normal group were reported as full term babies. Whether these pre-natal factors were directly involved in the intellectual development of the retarded or control children could not be determined.

B. Delivery: Approximately 65% of the institutionalized retarded children and 80% of the control were born in hospitals, but 53% of the EMH group were born at home. When this subgroup is compared to normals, a significant difference occurs. This may well be related to economic variable although no causal relationships were determined. However, physicians were reported to attend practically all births, regardless of group. Mothers of retarded children reported fewer hours in labor than those of the control group (59% vs. 29% respectively, in labor four hours or less). Whether this is an artifact of memory of the mother involved, or of previous pregnancies, or of some other factor,

could not be determined. Questions about parents' attitudes towards delivery also revealed striking differences between the groups. Of attitudes towards delivery, 73% of mothers and 71% of fathers of retardates reported negative attitudes, while only 22% and 18% respectively of controls' mothers and fathers reported negative attitudes. It may be recalled that 56% of retardates' parents reported not wanting the child.

C. Natal condition of Child: Only 73% of retardates but 92% of control children were rated by their parents as being in "good health" at birth. No instruments were used in the births of approximately three-fourths of both groups. Anesthesia was used in 60% of the controls' births and 40% of the retardates' births. The latter difference might be due to the fact that more normal children were born in hospitals.

As a group, retarded ss weighed less at birth than did the controls. For example, 24% of retardates but 5% of normals were reported to weigh five pounds or less; 6% of retardates and 11% of normals weighed nine pounds or more. The latter weight difference is not significant.

D. Post-natal Development Factors:

(a) Feeding variables. Table 6 suggests that more retarded children as infants were exposed to self-demand feeding than their normal counterparts, but this difference may be due to sampling factors. Considerably more retardates were reported to have been bottle fed than breast fed. While mothers of both groups reported a higher percentage of their children were bottle fed rather than breast fed, more mothers of the control group tended to breast feed their children than mothers of retarded children.

Age of weaning provides another means of differentiating the

groups. A significantly larger percentage of EMH retarded children than normals were weaned after twenty-one months of age, although the institutionalized retardates as a group were not different from the controls. There seems to be little evidence from available data to suggest that the groups were different in terms of reported balance of diet. Although slightly higher percentage of normal mothers reported "unbalanced" diets for their children during infancy.

(b) Motor Development. No significant differences in age of beginning to creep were reported, although approximately 50% of EMH retardates and 62% of normals were reported to have crept by eight months of age. Only 25% of EMH retardates and none of the normals were reported to have begun creeping after eleven months of age, but the *Ns* for the groups are so small that generalizations cannot be made about this variable. None of the retardates and 19% of the normal children were reported to have never crept. The tendency is for retardates to demonstrate such behavior at a later age than normals.

Similar findings are true with respect to age of walking. Only 29% of retardates but 85% of normal children were walking by the end of their thirteenth month; however, only 45% of retardates but practically every normal child was walking by the end of the sixteenth month. On the other hand, approximately one-third of the retarded group did not walk prior to their twenty-third month, while all normals were walking by that time. A clear difference between groups is indicated in terms of this type of motor development.

There seem to be no clear differences in handedness between the two groups.

(c) Toilet Training. Results indicate that retarded

children were older as a group than the normal controls in achieving bowel and urinary control. For example, only 2% of retardates achieved bowel control by twelve months of age but 26% of the normal group did so; conversely, 77% of retardates had not achieved control by twenty-two months of age as contrasted with only 34% of normal children. Similarly, 18% of retardates and 43% of normals had achieved urinary control by eighteen months of age, while 81% of retardates but only 51% of normals had not achieved control by age twenty-two months. Cathartics were used for 29% of children in both groups.

All the categories dealing with motor development except handedness and use of cathartics show significant differences between retarded children and normals, in favor of the latter group.

(d) Language Development. Developmental norms reviewed by McCarthy (1956) suggest that the majority children in our culture begin to use discrete words as language by the fifteenth month. However, only 31% of the retarded group were reported to use discrete words by this age, and 53% of them did not begin to use words until after their eighteenth month of life.

The same order of delay was demonstrated in connecting words into phrases. Most retardates (95%) did not begin to use phrases until the twenty-second month or later (5% of them after the twenty-fifth month), while only 26% of the control group were delayed until the twenty-second month, with only 9% reporting delay until the twenty-fifth month.

At the time of the study, very few of the retardates could read at all and, of those who could read, none had achieved higher than the third grade reading achievement level. Conversely, all the control

children could read and none was retarded more than eleven months in reading achievement. Several were accelerated up to four years beyond their grade-level. Data from Table 6, section 5, indicate that 87% of retardates do not read at home at all, and none is reported to read more than one-two hours per week. Mostly, their reading consists of comics and "picture-story books". In the control group, 53% were reported to read at least three hours a week and 37% read more than six hours per week. Their reading material consists of comics, newspaper, magazines of several types, and various types of books including adventure, sports, biography, science, and romance.

(e) School. When parents were asked whether their children liked or disliked school, 80% of the retarded group and 93% of the control group indicated they thought their children liked school with a significant difference favoring reports of retarded children "strongly" liking school. Only 20% of retardates' parents and 6% of control parents reported their children either liked or strongly liked school. These findings are interesting in terms of the childrens' own statements about school (See Section 2 this chapter).

(f) Intelligence. As might be expected, a considerable difference was found between groups when parents were asked to estimate the general intelligence level of their children. Only 23% of retardates' parents considered their children either average or bright whereas in tested intelligence they are not. On the other hand, 62% reported their children to be "slow" and 15% of them to be "very slow". Only 30% of controls' parents consider their offspring as "average", but 55% of them consider their children as "bright" and 8% consider their children as "superior". Only 6% of the controls' parents consider their chil-

dren to be "slow". In view of the range and proportions of IQs in each group, the parent estimates are not very deviant from the performance of the children in both groups.

Summary.--In practically every category of the case history significant differences occur between retarded children and their controls. It is to be expected that children with lower IQs tend to represent, as a group, more deprived socio-economic and cultural families. This study shows that they also, as a group, demonstrate more deviant developmental histories and personal-social behaviors.

Draw-A-Person Scale.--The DAP was included in the study as a means of evaluating behavior of retarded and normal children when it became impossible to obtain reliable and scoreable responses from retardates on the Rorschach or Thematic Apperception Test. A review of the literature suggested 39 scoreable aspects of the DAP which could be related to personality variables. These were selected for analysis. Ss made drawings of the same-sex and opposite-sex figures according to instructions described earlier under Procedures.

The following analysis deals with occurrence, in percentages, of DAP criteria for normals, combined retards, and the EMH and institutionalized (Lincoln School) sub-groups. Data are summarized in Table 7. Significant differences between groups are indicated by asterisks, which are given for the pairs of criteria under consideration. For example, the Table shows there are significant differences in the percentages of EMH and institutional boys who include hair on same-sex figures (.05 level) and on opposite-sex drawings (.01 level), as well as between percentages of all retards and normals who include hair on opposite-sex drawings (.05 level). Differences between retarded sub-

TABLE 7
OCCURRENCE IN PERCENTAGES OF DRAW-A-PERSON CRITERIA: BOYS

Variable	EMH (N-35)		Lincoln (N-26)		All Retards (N-61)		All Normals (N-38)	
	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex
Location ^A								
(1)	15	13	28	33	20	22	28	21
(2)	0	3	8	8	3	5	3	12
(3)	9	3	0	0	5	2	11	18**
(4)	0	0	0	4	0	2	3	6
(5)	76	81	64	54	71	69*	53	42*
Size ^B								
(1)	66**	71	40**	54	55**	64	81**	79
(2)	17	16	16	25	16	18	14	15
(3)	0	0	16	8	7	4	0	0
(4)	17	13	28	17	22*	14	5*	6
Perspective ^C								
(1)	89	84	84	83	87*	84	70*	76
(2)	11	13	4	4	13	9	30	21
(3)	0	3	12	13	0	7	0	3

A Location of drawing - (at least 75% of drawing occupied): (1) upper left $\frac{1}{4}$ of page (3) lower left $\frac{1}{4}$ of page (5) center of page

B Size of drawing: (1) less than $\frac{1}{4}$ page in length & width (3) over $\frac{1}{4}$ page in width but not in length (2) over $\frac{1}{4}$ page in length but not in width (4) over $\frac{1}{4}$ page in width and length

C Perspective: (1) facing forward (2) facing sideways (3) confused (combination of front & side)

* .05 level of significance

** .01 level of significance

TABLE 7 (Continued)

Variable	EMH (N-35)		Lincoln (N-26)		All Retards (N-61)		All Normals (N-38)	
	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex
Balance	68	77*	68	54*	68	67	72	88
Activity	8	10	8	12	8	11	16	12
Erasures	26	26	16	8	22**	18**	62**	52**
Head ^D								
(1)	14	3	4	4	10	4	14	0
(2)	14	16	12	0	13	9	19	18
(3)	72	81	84	96	77	87	67	82
Mouth ^E								
(1)	91*	100	68*	92	82	96	94	97
(2)	25	32	24	18	38	26	34	34
(3)	75	68	76	82	62	74	66	66
Hair	80*	32**	48*	94**	67	58**	73	97**
Hat	14		24	0	18		14	3
Ears	68*	32	40*	38	57	34	70	18
Eyes	100	97	100	100	100	98	92	97
Eyebrow	54	55*	44	25*	50	42	49	52
Eyelash	6	10	0	12	3	11	5	15
Empty eye	26	26*	36	54*	30	38	32	30
Dot	40**	42*	8**	12*	27	29	14	18
Pupil in eye	34	29	44	33	38	31	49	48
Teeth	11	13	16	21	13**	16**	0**	0**

D Head Size: (1) less than $\frac{1}{2}$ the length & width of trunk (2) over $\frac{1}{2}$ the width of trunk, less than $\frac{1}{2}$ the length of trunk.
 (3) over $\frac{1}{2}$ the width of trunk, more than $\frac{1}{2}$ the length of trunk.

E Mouth: (1) presence of (2) single line ("Slash") (3) 2-dimensional ("Lips")

TABLE 7 (Continued)

Variable	EMH (N-35)		Lincoln (N-26)		All Retards (N-61)		All Normals (N-38)	
	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex
Nose	91	90	72	88	83	89	92	91
Neck	46	58*	28	21*	38**	42**	84**	82**
Arms	83	90	68	83	77**	87	100**	97
Arms rigid	7	10	0	5	3*	8	19*	12
Hands	46*	58	20*	33	35*	47	62*	61
Fingers	63	77*	56	50*	60	65	62	73
Feet	77	71	68	58	73	65**	81	91**
Clothing	68	68	52	54	62	62**	76	88**

OCCURRENCE IN PERCENTAGES OF DEAN-A-PERSON: GIRLS

Variable	EMH (N-14)		Lincoln (N-22)		All Retards (N-36)		All Normals (N-26)	
	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex
Location ^A								
(1)	29	29	14	20	20*	23	44*	33
(2)	0	0	0	5	0	3	0	0
(3)	0	0	24	5	14	3	4	4
(4)	0	7	0	0	0	3	0	0
(5)	71	64	62	75	66	70	52	63
Size ^B								
(1)	93**	93*	24**	50*	51	68	64	67
(2)	7*	0*	38*	30*	26	17	28	33
(3)	0	7	5	5	3	6	0	0
(4)	0	0*	33	15*	20	9	8	0

TABLE 7 (Continued)

Variable	EMH (N-14)			Lincoln (N-22)			All Retards (N-36)			All Normals (N-26)		
	% Same		Opposite	% Same		Opposite	% Same		Opposite	% Same		Opposite
	Sex	Sex	Sex	Sex	Sex	Sex	Sex	Sex	Sex	Sex	Sex	Sex
PerspectiveC												
(1)	100	93		95	100		97	97		68	71	
(2)	0	7		5	0		3	3*		28	29*	
(3)	0	0		0	0		0	0		4	0	
Balance	57	64		71	65		66	65		84	83	
Activity	14	29		19	10		17	18		24	17	
Emasures	36*	21		5*	30		17	26*		36	54*	
Head												
(1)	0	0		5	10		3	6		8	0	
(2)	7	0		9	10		9	6		16	21	
(3)	93	100		86	80		88	88		76	79	
Mouth												
(1)	91*	100		68*	92		82	96		94	97	
(2)	36	46		10	10		20	19*		16	43*	
(3)	64	54*		90	90*		80	81*		84	57*	
Hair	100	64		81	80		88	74		100	96	
Hat												
Ears	36	43		57	70		48**	59		8**	46	
Eyes	100	100		100	100		100	100		100	100	
Eyebrow	43	36		67	50		57	44*		68	71*	
Eyelash	21	14		14	10		17	12		28	12	
Empty eye	29	43		48	55		40*	50*		16*	21*	
Dot	57**	36		5**	10		26	20		20	29	
Pupil in eye	14*	21		48*	35		34*	29		64*	50	
Teeth	14	21		19	20		17**	20**		0**	0**	
Nose	93	100		86	85		88	91		100	100	
Neck	57	50		48	45		51**	47**		88**	96**	
Arms rigid	100	100		86	85		91	91		100	100	
Hands	0	0		0	6		0	3		4	12	
Fingers	50	50		43	45		46	47		64	62	
	36	64		57	50		48	56		64	71	

TABLE 7 (Continued)

Variable	EMH (N-14)		Lincoln (N-22)		All Retards (N-36)		All Normals (N-26)	
	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex	Same Sex	Opposite Sex
Feet	86	71	90	90	88	82	92	96
Clothing	71	71	90	50	83	59*	96	96

groups and normals are not indicated in the table but significant differences between these groups will be noted in the context.

Machover (1949) has suggested that location of the figure represents a personality indicator. Specifically, figures occupying the left side of the page are supposed to be self-oriented, while placement on the right side is supposed to represent an environment-oriented person. Swensen (1957), in his review of DAP studies, concludes that this hypothesis has not been confirmed. Our data show that approximately half of the normals placed both figures in the middle of the page, with the upper left quarter of the page next preferred. Significantly larger percentages of EMH children placed the same-sex and opposite-sex drawings in the center of the page, with correspondingly fewer selecting the upper left quarter and very few selecting any other placement. The institutional retards' placements were very similar. De Martino (1954) reported 31% of male retards put their drawings in this placement. This is not significantly different from our group. These data neither confirm nor deny Machover's hypothesis about figure-placement and personality factors, but the similarities between groups in selecting sections of the page for figure-placement indicates little variation between the groups. Normals tend to be more variable in location preferences but, except for a tendency in boys to select the lower left quarter of the page more often for opposite-sex drawings and to select correspondingly less often the center for opposite-sex drawings, and for normal girls to select the upper left one-fourth of the page for same-sex drawings, there are no signs which suggest the location placements of the drawings of either group are different.

Very few studies have been reported dealing with size as a DAP

variable for retards in contrast to normals. Machover (1949) suggests retards draw larger figures than normals. Our data show a significant difference in size of same-sex drawings in favor of normal over retarded boys, but no size differences between the groups for opposite-sex drawings occur. Same-sex differences are attributable to institutional retards, whose drawings are significantly larger than either EMH retards or normals. Such differences are demonstrated in terms of variables (1) and (4) in Table 7, where a higher percent of normals drew small figures and a higher percent of retards, especially institutional retards, drew figures larger than one-quarter of the page in length and width. This percentage is very similar to De Martino's (1954) groups of male retards' drawings. He reported 37% of his institutional sample drew small figures. Obviously, our EMH group is more like the normal groups than the institutional retards in the size of their drawings. Whether this is because of higher "self-esteem" or "energy level" as Machover (1949) suggests, we do not know. It is interesting, however, that EMH retards and normals got lower anxiety scores on the CMAS than Lincoln retards.

The only difference which occurs between the groups in terms of perspective (face-forward vs. profile drawings) is in terms of same-sex drawings. Normals drew significantly fewer face-forward drawings than either group of retards and total retards. None of the other categories show differences between groups. Whether the difference noted suggests that normals are more "evasive", according to Machover's (1949) hypotheses, is a moot point. Our impression, from clinical behavior notes, is that this is not so.

There are no significant differences between normals and re-

tards in terms of the suggestion of balance or body activity in either same-sex or opposite-sex drawings. From this, we conclude that these indicators are not useful for differentiating mental retards from normals. De Martino (1954) has reported that 63% of his male retards drew large same-sex figures, but 72% of our EMH Ss and 84% of Lincoln Ss drew large same-sex figures, while 81% and 91% of them respectively, drew large opposite-sex figures. Since 67% normals also drew large same-sex figures and 82% drew large opposite-sex figures, this criterion does not differentiate the major groups under investigation. From this we deduce that Machover's hypotheses about head-size being an indicator of "intellectual power, social balance and the control of body impulses" (Machover, 1949, p. 36), lacks validity.

One DAP criterion which emphatically differentiates normals from retardates is the use of erasures in the drawing of both figures. Our interpretation is that this represents a greater ability in normals to detect unsatisfactory aspects of the drawings rather than indicating greater "conflict" for this group, which Machover suggests is the meaning of this criterion. In addition, since normals got significantly lower ("less anxious") scores than retardates on the Children's Manifest Anxiety Scale, Machover's hypotheses seems untenable.

Practically all normal and EMH subjects included mouths on both drawings but only 68% of Lincoln boys included mouths on their same-sex drawings. However, 92% included mouths on their opposite-sex drawings. What this means in terms of personality factors is open to question at this point. There are significant differences between normals and retards in terms of the type of mouth drawn. Normals tend to draw two dimensional mouths more frequently than retards, and correspondingly fewer normals draw "slash" mouths. One interpretation of

this is that these differences are probably due more to intellectual than "personality" differences between the groups.

Inclusion of hair as a criterion provided some interesting differences between normals and total retardates and among the sub-groups of retarded Ss. Although approximately the same percent of all retarded and normal boys included hair on same-sex drawings (67% and 73%, respectively), 97% of normal boys but only 58% retarded boys included hair on opposite-sex (girl) figures. There were no differences in percentages of retarded and normal girls who included hair on both same-sex and opposite-sex drawings. Many more retarded girls than boys included this body feature. This difference cannot be accounted for in terms of either differences in numbers of boys and girls in the two groups, nor in terms of a serial effect, since both groups tended to draw their own sex first. The major source of the difference seems to be a sampling factor. The EMH male group, for unknown reasons, decreased significantly in their inclusion of hair on opposite-sex drawings and it is this decrease which lowered the total retarded group percentage for this criterion. Our conclusion is that inclusion of hair is probably not a very significant criterion in differentiating the intelligence groups, but rather is due to the sex differences mentioned.

There are no significant differences between the groups in terms of including a hat on the figures. Neither retarded nor normal girls include hats significantly more than boys do.

While there is a greater tendency for EMH boys to include ears on their same-sex drawings more than institutional males, this is not true for girls (possibly because their drawings of girls included hair which eliminated necessity for ears). A similar percentage of girls did

include ears for boys, however. Our impression is that this criterion, whatever its significance for personality interpretation, is not useful as a means for differentiating normals from retards.

The same conclusion is given with respect to inclusion of eyes in the drawings of both male and female retards and normals. Practically all Ss included these body parts. And while a significantly larger percentage of normal than retarded girls included eyebrows on their opposite-sex (*i.e.*, boy) drawings, this difference did not hold for boys. Lincoln School boys did not, as a group, draw eyebrows on girls figures as much as EMH boys but, when both groups of boys were combined, there was no differentiation on this criterion from normal boys' drawings. An incidental finding was that the percent of retards (and normals) from our group including eyebrows was similar to that reported by De Martino (1954) for male retards. Approximately one-half of our retards and normals of this age group tend to include eyebrows.

Very few boys and girls in our groups included eyelashes on either of their figures. More girls than boys in both IQ groups tended to draw lashes, but there were no significant differences between the normal and retarded girls' drawings, or between the boys'. The analysis did not permit a testing of Machover's hypotheses that inclusion of eyelashes has psychological significance but our data suggest that inclusion of eyelashes probably is related more to factors other than personality differences for the age levels of our groups.

A sex difference between normals occurs in the occurrence of "empty eye" drawings. These relatively crude eye elaborations are much less common among girls than boys--and significantly less common among normal than retarded girls. Approximately one-third of both groups of boys draw "empty eyes" and 40%-50% of retarded girls do. Only 16%-21%

of normal girls do so, however. Machover (1949) suggests that the "empty eye" is related to egocentricity and immaturity. While it is conceivable that normal girls are more mature and less egocentric than the retarded girls and normal and retarded boys, our data certainly do not confirm Machover's hypothesis.

The "dot eye" differentiates institutionalized boys and girls and EMH and normal children. The Lincoln group used significantly fewer "dot eyes" than any other group. The exact meaning of this difference is unknown since, commonly, presence of such a type of eye presumably represents intellectual inferiority (Machover, 1949). In this respect, our institutional sample is significantly different from De Martino's (1954), in which 53% of retardates drew "dot eyes". Our data differ greatly from De Martino's on this variable.

A sex difference among retardates occurred in terms of drawing a pupil in the eye. EMH girls drew in pupils far less frequently than did institutional girls (14% and 21% vs. 48% and 35% for same-sex, opposite-sex drawings) and this contributed heavily to a significant difference in such inclusions between all retarded girls and normal girls. Such differences were not observed among boys, although the tendency was for normal boys to draw eye pupils more than retards.

One of the most striking differentiations between IQ groups occurred in the drawing of teeth. None of the normal boys or girls drew teeth but between 13% to 20% of retards did so. De Martino (1954) reports 21% of his male retards drew teeth. Whether this represents significantly more aggression on the part of retards than normals, as Machover (1949) suggests, we do not know. But this is one criterion which clearly differentiates boy and girl intelligence groupings.

There are no significant differences in inclusion of the nose,

between intelligence groups or between sexes. Between 83% and 100% of all Ss in each group included this body feature. The figures for retards (83%-91%) correspond to De Martino's retardates figures (83%).

Differences are evident in terms of including a neck on the figure. While 82%-96% of normal boys and girls drew a neck in their figures, only 38%-42% of boy retards and 51%-49% of girl retards included this body feature. This appears to be a fairly useful criterion for differentiating figure drawings of normals from retards in the age range covered by this study.

No significant differences occurred between girls in terms of arms or arm rigidity. A difference among boys favoring normal boys occurred in terms of including arms on same-sex figures only. A criterion which differentiated both male and female normals from retardates was the drawing of hands. Of normals, 82% included hands on same-sex drawings, 84% on opposite-sex drawings. While far larger percentages of normal girls than retarded girls included hands, the difference was significant only at the 10% level. Since 26% of institutionalized male retardates in another study were reported to include hands (De Martino, 1954), this too, seems to be a useful criterion for differentiating retardates from normals. But Machover's hypothesis about the importance of the Ss contact with environment being related to occurrence of hands was not substantiated by this study.

No significant differences occurred between normal and retarded girls in terms of including feet or clothing on their figures. Most girls included both items. Fewer retarded than normal boys, particularly in the institutionalized group, included either feet or clothing or their drawings of girls. Whether or not this represents more sexual

confusion, in terms of Machover's hypothesis about clothing, or whether it is simply a function of sex-IQ differences, could not be determined from this study.

In summary, the DAP criteria which appear useful as differentiators of retardates and normals, seem to be (1) the presence of more erasures in normals, (2) the non-occurrence of teeth in normals' drawings, (3) the inclusion of necks in normals' drawings, (4) a definite tendency for hands to occur more frequently in normals' drawings, and (5) the occurrence of clothing in female figures in normals' drawings. Most of Machover's hypotheses about relationships between figure-drawing and behavior characteristics either were seemingly contradicted or not substantiated by this study.

Vineland Social Maturity Scale.--Responses from the parents who supplied information for the Social Maturity Scale indicate that the mean SQ scores for normals were lower than their mean IQ scores (mean SQ 102.45 vs. mean IQ 110.54, respectively). There were no significant differences between normal boys' and girls' scores, although girls received higher mean SQ scores.

Whereas the control group SQ scores were lower than their IQ scores, the EMH SQ scores were higher than their IQ scores (mean SQ 75.71 vs. IQ 67.80) and there was more variation among SQ than IQ scores (sigma SQ 12.33 vs. IQ 8.94). Thus SQ scores for both groups were closer to the hypothetical population mean than were their IQ scores.

These findings suggest there may not be so much difference between non-institutionalized retards and normals with respect to social maturity (at least as measured by the Vineland Scale) as there is in IQ. Caution needs to be exerted in making such conclusions, since the measures of "social maturity" used here are derived from parents' reports

TABLE 8

DIFFERENCES BETWEEN NORMAL AND EMH RETARDED CHILDREN
VINELAND SOCIAL MATURITY SCALE

Group	N	MN	SD	t-ratio
Normals	61	102.45	10.61)	12.403**
Retardates ¹	52	75.71	12.33)	
Male Normals	36	100.53	9.93)	1.735
Female Normals	25	105.24	11.13)	
EMH Male Retards	36	74.83	11.85)	.768
EMH Female Retards	16	77.69	13.53)	

¹Only EMH Retards

** significant at .01 level

of childrens' behavior, rather than direct observation of the child's social behavior.

Measures of School Behaviors

Results from two measures of school behaviors were obtained from the EMH retardates and their normal control group. No data was obtained from or about the institutionalized retardates' school behaviors because they were tested during the summer of 1958. Therefore, for that proportion of children who did attend special classes in the Lincoln State School, teachers were not available for rating their behaviors. Attempts were made to interview these children about school but, since many of them had not attended classes because of limited facilities, it was decided not to include this group for comparisons on these measures.

Teacher Ratings.--The means and standard deviations for normals and EMH retardates are provided in Table 9. Since inspection of the data revealed the probability of few significant differences, either among groups or between groups, and since in any case interpretation of any differences would be tenuous at best, no tests of significance were employed.

Since interpretation of the results is attenuated because different teachers rated the retards and normals, and since most of the EMH teachers openly stated a bias for the children in their charge on questioning after results were obtained, and since practically all ratings of all children were rated "above-average" on practically all variables, it might be well to note several things about the inter-group comparisons. First, the general direction of ratings for each characteristic is the same in both groups. The retards were rated above

TABLE 9

TEACHER RATINGS OF CHILD BEHAVIOR

Means and Standard Deviations of Normal and EMH Retarded Children¹

Variables	NORMALS			All (N=51)		
	Boys (N=39)		Girls (N=12)		Mean	
	Mean	SD	Mean	SD	Mean	SD
Independence--dependence	4.205	1.488	4.250	1.164	4.216	1.419
Child's estimate of own ability	4.154	1.424	3.750	.433	4.059	1.274
Child's mood related to child's behavior	4.385	1.704	4.417	1.706	4.392	1.705
Need for immediate satisfaction	3.665	1.817	3.000	1.780	3.510	1.830
Desire for immediate satisfaction	5.103	1.865	4.833	1.463	5.039	1.782
Affection from adult	3.564	1.809	3.333	1.650	3.510	1.775
Cooperation--completion of work	3.154	2.007	2.500	1.708	3.000	1.960
Fearfulness	4.846	1.688	5.250	1.963	4.941	1.765
Maintains attention on work	4.436	1.429	4.250	1.689	4.392	1.496
Peer popularity	4.487	1.375	3.917	.862	4.353	1.296
"Emotional" (temper) behavior	3.744	1.721	3.500	1.384	3.686	1.651
Organization of verbal material	3.692	1.470	3.583	1.935	3.667	1.593
Vocabulary & language use (general)	4.077	1.385	4.167	1.724	4.098	1.472
Communication with others	4.821	1.738	5.083	1.754	4.882	1.745
Memory	4.590	1.691	4.083	2.139	4.471	1.819
Peer domination vs submission	3.821	1.152	3.583	.493	3.765	1.040
Orderliness	4.538	1.106	3.583	.759	4.314	1.111
Adaptation to novel situations	4.615	1.792	5.250	1.422	4.765	1.733

¹Rating 0 means "low degree of characteristic; rating 6 means "very high degree of characteristic"; ratings 1-5 are intermediate with rating 3 being the mid-point rating.

TABLE 9 Continued

Variables	RETARDED					
	Boys (N=40)		Girls (N=13)		All (N=53)	
	Mean	SD	Mean	SD	Mean	SD
Independence--dependence	4.200	1.453	3.846	.949	4.113	1.355
Child's estimate of own ability	4.250	1.624	3.462	1.278	4.057	1.583
Child's mood related to child's behavior	4.275	1.923	5.538	1.646	4.585	1.937
Need for immediate satisfaction	2.875	1.691	3.615	2.058	3.057	1.816
Desire for immediate satisfaction	5.150	1.994	4.000	1.797	4.868	2.010
Affection from adult	3.675	1.738	3.846	1.748	3.717	1.742
Cooperation-completion of work	3.525	2.025	3.769	1.928	3.585	2.004
Fearfulness	4.700	1.661	4.308	1.771	4.604	1.697
Maintains attention on work	4.125	1.792	3.692	2.090	4.019	1.878
Peer popularity	3.950	1.448	4.154	1.657	4.000	1.505
"Emotional" (temper) behavior	3.550	1.999	4.308	2.053	3.736	2.039
Organization of verbal material	3.825	1.716	4.154	1.460	3.906	1.663
Vocabulary & language use (general)	3.300	1.470	3.231	1.250	3.283	1.419
Communication with others	4.850	1.509	4.847	1.231	4.849	1.446
Memory	4.000	1.378	3.615	1.389	3.906	1.391
Peer domination vs submission	3.850	1.509	3.923	1.439	3.868	1.493
Orderliness	4.900	1.546	4.077	1.685	4.698	1.621
Adaptation to novel situations	4.000	1.549	4.308	1.539	4.075	1.552

TABLE 9 Continued

Variables	WHOLE GROUP					
	Boys (N=79)		Girls (N=25)		All (N=104)	
	Mean	SD	Mean	SD	Mean	SD
Independence--dependence	4.203	1.470	4.040	1.076	4.163	1.388
Child's estimate of own ability	4.203	1.529	3.600	.980	4.058	1.440
Child's mood related to child's behavior	4.329	1.819	5.000	1.766	4.490	1.829
Need for immediate satisfaction	3.266	1.798	3.320	1.954	3.279	1.837
Desire for immediate satisfaction	5.127	1.932	4.400	1.697	4.952	1.903
Affection from adult	3.620	1.774	3.600	1.721	3.615	1.761
Cooperation-completion of work	3.342	2.026	3.160	1.933	3.298	2.004
Fearfulness	4.772	1.676	4.760	1.924	4.769	1.739
Maintains attention on work	4.278	1.630	3.960	1.928	4.202	1.712
Peer popularity	4.215	1.438	4.040	1.341	4.173	1.417
"Emotional" (temper) behavior	3.646	1.870	3.920	1.809	3.712	1.859
Organization of verbal material	3.759	1.601	3.880	1.728	3.788	1.633
Vocabulary & language use (general)	3.684	1.480	3.680	1.568	3.683	1.502
Communication with others	4.835	1.626	4.960	1.509	4.865	1.600
Memory	4.291	1.568	3.840	1.804	4.183	1.640
Peer domination vs submission	3.835	1.345	3.760	1.106	3.817	1.292
Orderliness	4.722	1.359	3.840	1.347	4.510	1.407
Adaptation to novel situations	4.304	1.702	4.760	1.556	4.413	1.679

or below the mid-point rating for the distribution (4.0) on all characteristics that normals were. Second, the standard deviations for the retards are approximately the same as for normals (none deviates more than .4 of a point). Third, on only four characteristics was there as much as .5 of a point difference between the two major groups. On one of these (Cooperation-completion of work), the retardates were more favorable rated, on the other three (Vocabulary and Language use, Memory, and Adaptation to novel situations), they were rated to be inferior to normals. These ratings might be expected in terms of known IQ differences.

There was only one characteristic on which normals received mean ratings more than one point above the mid-point, Desire for immediate satisfaction. On one other rating, Fearfulness, normals received a "high" rating of 4.94. Conversely, only one "low" (3.0) rating, Cooperation-completion of work, was observed for normals.

If we can assume reliability of our teacher's ratings and a representativeness of normalcy in the children selected for the control group, our results suggest that this rating scale might have some utility for clinical ratings by teachers of school behaviors in children. The scale might have utility not only for teachers of normal children, but also for evaluating characteristics of retarded children. However, since all scores are biased (above the theoretical mid-point) one wonders whether this scale should not be revised before it is used in other research with retarded or normal children.

Interviews about school.--A description of and scoring criteria for the interview is given in Appendix B. The form and structure of the interview were developed by the principal investigator for another study

(Malpass, 1953). The four examiners who interviewed the children independently indicated that scoreable responses were elicited from all the children that each interviewed. The results of the interview represent the ratings of the children's statements about the aspect of school under consideration (e.g. achievement, teachers, or the like).

Mean and standard deviations of obtained ratings for normal and EMH children are presented in Table 10. None of the mean ratings for all normals is significantly different from those for all retards. From the obtained ratings, it is our impression that all the children interviewed, as a group, tended to have fairly positive feelings about school as an institution and for their particular school. Both groups reported positive feelings for their teachers as well, with the normal girls indicating highest regard and the retarded girls receiving the "lowest" (but still positive) ratings in this category. However, none of the differences between sub-groups was significant.

Although there were no significant differences in rated responses about peers, the mean score for girls in both normal and retarded groups indicates more favorable attitudes than those for the boys; both groups are "positive" in their reported peer-regard, however. The same trends are found with respect to reported feelings about school work (achievement) and discipline in school. Again, none of the inter-group or inter-sex differences is statistically significant.

The findings are of interest because, even though normals and retardates have different curricula, teachers and even classrooms (with the EMH children effectively being isolated from other children during school hours), there are no differences in their reported attitudes about school. Both groups are rated to have positive regard for school

TABLE 10

INTERVIEWS ABOUT SCHOOL

Means¹ and Standard Deviations of Normal, EMI and Retarded Children

Variables	Normals					
	Boys(N-39)		Girls(N-12)		All(N-51)	
	Mean	SD	Mean	SD	Mean	SD
School in general	2.179	1.258	2.000	1.000	2.137	1.205
Teachers	2.333	1.184	1.667	.850	2.176	1.150
Peers	2.231	1.187	1.917	.759	2.157	1.109
Achievement	2.615	1.053	2.417	.954	2.569	1.034
Discipline	3.231	.947	2.833	1.143	3.137	1.010

Variables	Retarded					
	Boys(N-40)		Girls(n-13)		All(N-53)	
	Mean	SD	Mean	SD	Mean	SD
School in general	2.150	1.370	1.923	1.328	2.094	1.364
Teachers	2.200	1.187	2.462	1.393	2.264	1.246
Peers	2.600	1.136	1.923	.616	2.434	1.073
Achievement	2.975	.724	2.692	.606	2.906	.708
Discipline	3.125	1.029	2.846	.662	3.057	.960

Variables	Whole Group					
	Boys(N-79)		Girls(N-25)		All(N-104)	
	Mean	SD	Mean	SD	Mean	SD
School in general	2.165	1.316	1.960	1.183	2.115	1.238
Teachers	2.266	1.188	2.080	1.230	2.221	1.201
Peers	2.418	1.176	1.920	.688	2.298	1.100
Achievement	2.797	.920	2.560	.804	2.740	.899
Discipline	3.177	.991	2.840	.924	3.096	.986

¹Rating 0 means very good rated response to aspect of school in question. Rating 6 means very poor rated response to aspect of school in question. Rating 3 is the mid-point rating.

in general, teachers, and peers. Although the retardates (particularly the boys) obtained practically a "neutral attitude" rating (theoretically 3.0), which was slightly higher than the normal groups' mean ratings, actually only the category Discipline received a mean rating above ("worse than") this theoretical mid-point.

The results of this study indicate no essential differences between retardates and normals in rated attitudes towards school. Apparently the children in the EMH classes are just as happy and satisfied with their school situations as the normals are with theirs, at least if credence can be attached to their reports about the aspects of school with which the interview was concerned.

Health Measures

Forty-nine EMH children were examined by the pediatrician. None was considered neurologically defective so only general physical examinations were given. Results of these examination are given in Table 11.

TABLE 11
HEALTH STATUS OF EMH RETARDATES

Characteristic	Normal Range	No. Ss Normal	Below Normal	Above Normal	No Data
Auxodrome	65- 70	8	27	11	3
Blood Pressure	100-120	24	19	5	0
Pulse	Approx. 100	33	0	10	5
General Appearance	Clinical Rating	35	6	7	0
Characteristic	No. Ss Normal	No. Ss Deviant	No Data		
Posture	45	4 - 2 loxdosis	---		
Eyes	41	1 - neptagnus	---		
Chest	47	1 - rhonchi	1		
Heart	38	10 - murmurs	1		
Extremities	47	1 - movement limited	1		
Genitalia	45	4 - (see context)	---		
Hernia	47	2 - present	---		
Gait, skin, head symmetry, ears, nose, throat, neck, abdomen	All normal	---	---		

The EMH children showed some common physical anomalies. The auxodrome score, based on Wetzel grid ratings, reveals that only eight children were "normal" in terms of the ratios of height, weight and age. Of the total group (N-49), 27 were rated "below normal" and 11 were rated "above normal" by the Wetzel charts. In this group, 19 children had low blood pressures and 5 had high blood pressure; 10 children had pulse counts above normal, none below normal; 7 children had "general appearance" rated "dull", 6 rated "bright", and 35 rated "average".

The remaining characteristics, listed in the table, were noteworthy only because few anomalies were noted. The most striking anomaly was the relatively high number of children with heart murmurs (10 out of 48 children tested). According to the pediatrician, this is a much higher incidence than is found in the normal child population.

Four children had "poor" posture. Two of these children demonstrated lordosis, two scoliosis. Four children also had genital anomalies. These included one child with "infantile testicles - large penis", one "marble-sized mass above right testicle and hypospadias", one "soft atrophic tissues, left testes and left varicocoeal", and one "right testicle not palpable". Comments about two girls (both with rated "average genitalia") were "right breast areola--little breast tissue. Left breast normal", and "bilateral-mature development".

Unfortunately, no comparisons with normals were available.

Section 2

Intercorrelations of Clinical Measures

The clinical measures which yielded quantified results suitable for correlation analysis were the intelligence tests (WISC for retar-

dates, CTMM for normals), the Progressive Matrices (1956 edition), the Oseretsky Motor Development Scale, the Children's Manifest Anxiety Scale, and the Vineland Social Maturity Scale. Product moment correlations were run between all these measures, using mental age and IQ separately. Chronological age was also correlated with results of all the clinical measures mentioned. These correlations are found in the Appendix. They are not presented for analysis because the group was heterogeneous in regard to age and for some of the measures, notably the Oseretsky, PMT and CMAS, raw scores rather than age-scores were used. Therefore, the product moment correlations were not considered suitable for data analysis.

In order to account for possible chronological age effects, CA was partialled out of all the product moment correlations and the resulting partial r 's were used for data analysis. These data are presented in Table 12.

Computations were made to account for all intercorrelations between the test scores previously mentioned for all normal S s, total retarded S s, sub-groups of retards, all boys, all girls, and total S s. These data are found in the first section of Table 12.

The second part of Table 12 includes a breakdown of intercorrelations by sex and major grouping. This permits a comparison of normal boys and girls with EMH and institutionalized boys and girls, and with all retarded boys and girls, for each of the variables under consideration.

The analysis was made in terms of (a) the correlations between MA, IQ and other test results (Table 12 variables 1, 3 and 4-7); (b) the Progressive Matrices (Table 12 variable 6) and the Vineland SMS

TABLE 12

PARTIAL CORRELATIONS BETWEEN CLINICAL MEASURES - CHRONOLOGICAL AGE HELD CONSTANT

Variables ¹	All Subjects		All Boys		All Girls		All Normals		All Retards		EMH Retards		Lincoln Retards	
	N	r	N	r	N	r	N	r	N	r	N	r	N	r
1 & 3	184	.983	119	.977	65	.989	71	.989	113	.918	56	.983	57	.830
1 & 4	171	.641	111	.615	60	.688	68	.012	103	.406	47	.415	56	.365
1 & 5	157	-.605	102	-.556	55	-.694	63	-.215	94	-.192	41	.008	53	-.105
1 & 6	171	.821	112	.787	59	.883	67	.502	104	.483	48	.487	56	.405
1 & 7	113	.661	72	.634	41	.732	61	.024	---	---	52	.250	---	---
3 & 4	171	.656	111	.630	60	.703	68	.082	103	.442	47	.440	56	.447
3 & 5	157	-.570	102	-.516	55	-.662	63	-.213	94	-.137	41	.025	53	-.068
3 & 6	171	.821	112	.794	59	.867	67	.541	104	.506	48	.511	56	.508
3 & 7	113	.704	72	.688	41	.758	61	.049	---	---	52	.142	---	---
4 & 5	157	-.374	102	-.327	55	-.506	63	.057	94	-.009	41	.019	53	.152
4 & 6	171	.668	112	.655	59	.693	67	.217	104	.446	48	.311	56	.492
4 & 7	113	.487	72	.472	41	.475	61	-.102	---	---	52	.145	---	---
5 & 6	171	-.546	112	-.506	59	-.623	67	-.196	104	-.199	48	-.114	56	-.148
5 & 7	113	-.432	72	-.426	41	-.556	61	-.120	---	---	52	.069	---	---
6 & 7	113	.634	72	.664	41	.614	61	.110	---	---	52	.239	---	---

¹ 1--Mental Age

4--Oseretsky Motor Development Scale

6--Progressive Matrices

3--Intelligence Quotient

5--Children's Manifest Anxiety Scale

7--Vineland Social Maturity Scale

TABLE 12 Continued

PARTIAL CORRELATIONS BETWEEN CLINICAL MEASURES - CHRONOLOGICAL AGE HELD CONSTANT

Variables ¹	ALL NORMALS				ALL RETARDS				EMH RETARDS				INSTITUTIONAL RETARDS			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r
1 & 3	45	.989	26	.994	74	.894	39	.988	40	.983	16	.984	34	.789	23	.991
1 & 4	44	.025	24	-.054	67	.380	36	.475	34	.365	13	.562	33	.395	23	.284
1 & 5	39	-.194	24	-.243	63	-.169	31	-.199	31	.053	10	-.003	32	-.020	21	-.321
1 & 6	44	.376	23	.642	68	.460	36	.536	40	.471	13	.556	33	.391	23	.455
1 & 7	36	-.076	25	.153	--	---	--	---	36	.243	16	.365	--	---	--	---
3 & 4	44	.069	24	.057	67	.423	36	.495	34	.339	13	.755	33	.515	23	.266
3 & 5	39	-.197	24	-.235	63	-.089	31	-.202	31	.066	10	.002	32	.059	21	-.316
3 & 6	44	.432	23	.643	68	.484	36	.551	35	.442	13	.754	33	.522	23	.469
3 & 7	36	-.057	25	.189	--	---	--	---	36	.154	16	.249	--	---	--	---
4 & 5	39	.114	24	-.030	63	-.037	31	.038	31	.012	10	-.271	32	.110	21	.218
4 & 6	44	.102	23	.339	68	.480	36	.340	35	.256	13	.536	93	.594	23	.050
4 & 7	36	-.160	25	-.108	--	---	--	---	36	.121	16	.211	--	---	--	---
5 & 6	44	-.149	23	-.261	68	-.199	36	-.127	35	-.078	13	.004	33	-.156	23	-.200
5 & 7	36	-.167	25	-.101	--	---	--	---	36	-.025	16	-.041	--	---	--	---
6 & 7	36	.132	25	.093	--	---	--	---	36	.284	16	.393	--	---	--	---

¹ 1--Mental Age

4--Oseretsky Motor Development Scale

6--Progressive Matrices

3--Intelligence Quotient

5--Children's Manifest Anxiety Scale

7--Vineland Social Maturity Scale

(variable 7); (c) the Oseretsky Scale (variable 4) and the remaining tests (variables 5, 6, 7); and (d) the Children's Manifest Anxiety Scale (variable 5) and the remaining tests (variables 6 and 7).

Partial Correlations between Intelligence Measures and Other Tests

As might be expected, MA (variable 1) and IQ (variable 3) correlate with each other to a very high degree. For total Ss for whom both measures were available (n=184), the r was .983. For total normals (N=71), the r was .989, and for total retards (n=113), the r was .918. The normal boys and girls showed rs of .989 and .994, respectively. The total and sex-groupings of MH and institutional retards showed r from .789 to .988. Obviously, for all these groups MA and IQ correlate well with each other.

Because it was felt that there is merit in using both the MA and IQ as criteria for psychometric intelligence, both were used for comparisons with the other clinical measures. The comparisons using both intelligence criteria will be made together.

MA, IQ and Progressive Matrices.--When all Ss in the study were combined, the rs of both MA and IQ with the PMT were .821. This high degree of relationship needs to be interpreted with caution, however, since approximately two-thirds of the groups (107 Ss) were retarded. Thus the total Ss group is not representative of the total population. As might be expected, the rs between total boys and girls are also high, .794 and .867, respectively.

The correlations between the two intelligence criteria and PMT drop markedly when the sub-groups are compared. The correlations for normals, .502 (MA and PMT) and .541 (IQ and PMT) correspond with those reported by Bolton (1955) using group intelligence tests and the 1938

revision of the PMT. However, they are lower than those reported by Barrett (1956) using the CMT and the PMT. Barrett reported r_s of .70 with 4th grade normals. It is conceivable that the greater age-grade heterogeneity of our normal sample tended to reduce the r_s between these two measures. On the other hand, PM scores of normal girls in our study correlated much higher with both MA and IQ than did those of boys (.642 and .643, respectively, vs. .376 and .432).

The r_s between MA and PMT, and IQ and PMT, for retardates are slightly lower than for normals but correspond roughly with those reported by Stacey and Carleton (1955) who reported an r of .55 between WISC and PMT, and those by Stacey and Gill (1955), who reported an r of .58 between the Wechsler-Bellevue Form 1, and the PMT (1938 revision). Our obtained r_s between MA and PMT, and between IQ and PMT for all retardards were .483 and .506 respectively. The r_s for the EMH and institutional groups were .487 and .405, respectively (MA and PMT), and .511 and .508, respectively (IQ and PMT). As with the normals, EMH retarded girls' MA and IQ scores correlated higher with PMT than did the boys' scores (.556 for MA and PMT, and .754 for IQ and PMT vs. boys' r_s of .471 and .442, respectively). However, although institutional girls showed higher r than boys when MA and PMT were correlated, the boys' correlations between IQ and PMT were higher than the girls' (.522 vs. .469, respectively).

While none of these correlations demonstrates a very high degree of relationship between MA and PMT or IQ and PMT, all of the r_s are significant. On the basis of our results, it would not seem wise to substitute the Progressive Matrices for the CTM with normals or for the WISC with retardates. Obviously, however, this revision of the

PMT, because of its economy in administration and scoring, and because of its utility with non-verbal Ss, particularly retarded Ss, may be used effectively to evaluate the specific intellectual functions which its author claims for it, i.e. the ability to reason by analogy. It is recommended for use with both normals and retardates between the ages of 8-13.

MA, IQ and motor development.--Since the revision of the Oseretsky Scale used in this study was standardized as an age scale (Sloan, 1955), it was presumed that positive rs might result when it was compared with other types of age scales (MA and IQ). The chief purpose for making this analysis, though, was to determine the correlations between groupings of Ss, particularly between normals vs. retardates and between EMH vs. non-institutionalized retardates.

Correlations between MA and the OMDS for all Ss, and for all boys and girls, were .641, .615, and .688, respectively. The rs between IQ and OMDS were slightly higher, .656, .630, and .703, respectively. However, a preponderance of mentally retarded Ss in these groups prevents a generalization of rs to the age-population represented by these groups.

The rs between both MA and OMDS and IQ and OMDS for normals are very low and statistically not significant. They range from .054 (MA and OMDS for girls) to .082 (IQ and OMDS for all normals). For normals, then, the hypothesis that there is a significant relationship between intelligence and motor development, as measure by the OMDS, is rejected.

Significant relationships between these two variables were found for the retarded Ss, however. Correlations from .365 to .447

were found between measures of intellectual ability and the Oseretsky for the major groupings of retardates. MA and IQ scores of the EMH girls from EMH groups showed a higher r with Oseretsky scores than did those of the boys in both groups. In fact, the r .755 (IQ and OMDS) for this group was the highest recorded between these variables. However, a small N in this category casts some doubt about the representativeness of the obtained r s for this group. When both EMH and Institutional girls and boys are combined into groups, the girls' scores correlate more highly than those of boys for these variables.

In summary, the measures of intelligence and motor ability used in this investigation do not correlate with each other. This is in contradistinction to the results obtained by Sloan (1951a) with groups of 20 normal S s. However, the presence of positive r s between these variables for retardates is in agreement with Rabin's (1957) conclusions that motor proficiency and intelligence in mental defectives are correlated.

Motor ability is not a behavior which can easily be separated from other types of behavior. It is our impression that the Lincoln revision of the Oseretsky Scale has many uses in evaluating the developmental behaviors of retardates, however, and its availability and demonstrated usefulness commend it for such purposes.

MA, IQ and the Children's Manifest Anxiety Scale.--Since high scores on the CMAS represent "more anxiety", it was hypothesized that MA and IQ scores would be inversely related with CMAS scores. This has been previously reported by McCandless and Castaneda (1956a) with normal children. Results from our study are equivocal with respect to such relationships, however. Correlations of $-.605$ (MA and CMAS) and

-.570 (IQ and CMAS) were determined for total Ss (N-157). Similarly high rs were observed for total boys and girls groups (-.556 and -.694, respectively, for MA and CMAS, and -.516 and -.662, respectively, for IQ and CMAS). These rs correspond very well with those reported by McCandless and Castaneda, but caution should be used in generalizing from these groups' correlations since, as has been already indicated, a large proportion of the samples are mentally retarded children.

When the correlations of the major population samples are analyzed separately, the rs drop markedly. For example, the r between IQ and CMAS for all normals is only -.213 and for normal boys and girls, respectively, the rs are -.197 and -.235. These represent a low degree of relationship between these variables and do not support previous findings (McCandless and Castaneda, 1956a). (The rs between MA and CMAS for these groupings are very similar to the IQ-CMAS rs.)

The rs for both retarded groups are even lower than for the normals. The r between MA and CMAS for EMH retards is .008 and for the Lincoln groups is -.105. The rs between IQ and CMAS for these groups also cluster close to zero. None of the rs between MA or IQ and CMAS for the sex groupings of retards is higher than -.316 (institutional girls) and most cluster around zero.

These results suggest that the CMAS is relatively independent of IQ and MA as a measure of behavior, for both the normal and retarded groups used in this study. Since neither normals nor retardates demonstrate rs between intelligence and CMAS scores significantly different from zero, it seems even more reasonable to conclude that the differences obtained on the CMAS between normals and retardates indicate that retarded children tend to demonstrate more "anxiety" than their normal

counterparts.

MA, IQ and the Vineland Maturity Scale.--Since Vineland Scale scores were not available for institutionalized retards, analysis of relationships between these variables is restricted to the combined normal and EMH groups (N-113), the total boys and girls groups (Ns-72 and 41 respectively), total normal and EMH groupings (N-61 and 52, respectively), and the sex-groupings for the two major IQ groups.

In terms of previous reports, it was expected that there would be high positive correlations between MA and VSMS and between IQ and VSMS. This was true for the total group data ($\bar{r}$.661 and .704, respectively) and for total male and female groups ($\bar{r}$ s from .634 to .758 between these variables). However, as was true for other relationships between clinical measures, the $\bar{r}$ s dropped sharply for each sub-group. There is not a single $\bar{r}$ which demonstrates a significant relationship between MA and VSMS or between IQ and VSMS for any of the normal or EMH subgroups. The highest $\bar{r}$ is .365 (for EMH girls, N-16) but the N is so small that this $\bar{r}$ might be due to a sampling fluctuation.

These results were unexpected in light of previous research which shows much higher $\bar{r}$ s between both normals' and retardates' intelligence test scores and the VSMS. There are several possible reasons for the discrepancy between our data and those of other investigators. One is that, with respect to retards, other research deals exclusively with institutional retards while our sample is composed of retards who live at home, attend school daily, and participate in school and community activities much like normal children. The mean SQ scores for these children were significantly higher than their IQ scores. On the other hand, normal $\bar{S}$ s had lower VSMS scores than IQ scores, which might

have affected the r_s between these variables to some extent.

Such differences probably do not account for the low r_s altogether. It is possible that the reports of both parents of both retarded and normals were biased, although they would have to be in opposite directions if this were so. Since the interviewers underwent an orientation period in learning how to administer and score the VSMS, the probability of inadequate administration seems remote.

The best reason for the low r_s between these variables seems to be that there was greater variation in parents' reports about individual children, both retarded and normal, than in other studies. The standard deviations for both IQ groups (Table 8) are larger than those reported by Doll (1936). If our results are not due to a sampling function, these data suggest that the VSMS is less effective as a correlate of general intelligence than previously has been reported.

Progressive Matrices and Oseretsky Motor Development Scale.--

Relationships between these variables were of little more than academic interest to the investigators. Since IBM computation were possible without extra inconvenience or cost, however, the relationships were investigated.

A reasonably high positive r (.668) was observed between PMT and OMDS for the total group (N-171). The r for all boys (N-112) was .655 and for girls (N-59) the r was .693. These suggest that there are common elements being tapped by both measures. However, such an interpretation is tempered by the knowledge that the group is not representative of the total population of 8-13 year olds, since 104 of the total N of 171 were retarded children.

The r_s between these variables for normals (total, boys, and

girls) were .217, .102 and .339, respectively. None of them show significant relationships between PMT and OMDS.

However, the r s between PMT and OSMS for retardates are significant for practically every category analyzed. The total retarded group r was .446, the total EMH group r was .311 and the total institutional group r was .492. All these indicate that relationships between these variables for these groups are not due to chance factors. Similarly, the r s for the groups of all retarded boys (.480) and girls (.340) and for institutional boys (.594) indicate that scores on these two measures co-vary significantly for these groups. However, the groups of female retardates were too small to permit generalization concerning the observed r s, and the r for EMH boys was too small (.356) to demonstrate significant relationships between these variables.

While none of the significant r s noted above are high enough for accurate predictive purposes, they do suggest that, particularly for large groups of male retards, one could make rough estimates of motor proficiency scores from a knowledge of PMT scores, or vice versa.

Progressive Matrices and Children's Manifest Anxiety Scale.--

Convenience of computation was again the major factor involved in making possible the analysis of these variables. It was expected that there would be an inverse relationship between the two test means, since the PMT is presumed to be related to general intelligence. Negative relationships, ranging from -.623 (all girls) to -.506 (all boys) and -.546 (total N-157) were observed for the combined IQ groupings.

However, none of the r s between these variables is significant for any of the subgroups, both normal and retarded. They range from -.261 (normal girls) to +.004 (EMH girls) with most r s between -.11

and $-.19$. These data suggest that, for purposes of most research, there is little reason to suspect that co-variation in scores will occur between two measure. In this regard, PMT scores are no different from those of either MA or IQ in their relationship with CMAS scores.

Progressive Matrices and Vineland Social Maturity Scale.-- Prior to testing, it was hypothesized that there would be a positive correlation between the PM and VSMS since both purported to be, to some degree at least, related to general intelligence. The same patterning of correlation which has been described for other variables resulted from the computations of these variables, however. r s for the total combined group (N-113) was $.634$, for all boys (N-72) was $.664$, and for all girls (N-41) was $.614$.

None of the r s for the three groups of normal S s or for the EMH groups were high enough to conclude that other samples of similar IQ-age groups would demonstrate significant relationships on these tests. Although the EMH boys' group r was $.283$ and the EMH girls' group r was $.383$, both groups were composed of too few S s to make predictions.

It is presumed that the same factors which operated to result in low r s between IQ and VSMS were operating in terms of the PM and VSMS. Specifically, it seems reasonable to assume that the great variation in VSMS scores in terms of individuals in each intelligence group category served to reduce the size of the observed r s between these variables.

Oseretsky Motor Development Scale and Children's Manifest Anxiety Scale.--There was no reason to expect significant co-variation between these two variables, except that previous research had indicated

that both measures are related to general intelligence (Sloan, 1951a, McCandless *et al.*, 1956a). Consequently, relationships between the two tests were studied more out of curiosity than research rigor.

Actually, the lowest r between any two variables for the combined groups of all Ss resulted from the computation of OMDS and CMAS scores (-.374). While the combined girls group (N-55) r was -.506, suggesting a reasonable co-variation in scores for this group, the r for all boys (N-102) was -.327. And the rs between these variables for all subgroups of both normals and retards ranged from -.271 (EMH girls, N-10) to +.218 (institutional girls, N-21).

Since all these rs cluster so closely to zero, and none of the rs is significant, we conclude that there is no relationship between these two measures for the groups studied.

Oseretsky Motor Development Scale and Vineland Social Maturity Scale.--Relationships between these variables were investigated because it was convenient to do so. Only EMH retarded children and normals were included, because of lack of VSMS data on institutionalized retardates.

Although rs of .487, .472 and .475 were obtained between these two variables for the combined groups (N-113), total boys (N-72) and total girls (N-41), these groups cannot be considered representative of the age-sex populations indicated because of the large number of retarded children comprising these groups. And since none of the rs for the subgroups, either normal or EMH retarded, indicate any significant co-variation between these measures, we conclude that combined group rs are spuriously high because of sampling factors and that, in fact, no relationships exist between the measures under consideration for either normal or EMH groups.

Children's Manifest Anxiety Scale and Vineland Social Maturity

Scale.--Because there are no significant correlations between these variables for any of the normal or EMH retarded subgroups, we conclude that these two tests do not co-vary for the populations under investigation. Whether the lack of co-variation is due to sampling factors or to the "reality of un-relatedness" of the two tests cannot be determined, of course, but it had been expected that a significant co-variation would occur as a function of the nature of the two tests. There is no confirmation in our data for continuing such an hypothesis, at least for the groups for which data are available.

Correlations between School Behavior Measures

The two measures of school behavior, the structured interview of the child about school and the teachers' ratings of childrens' behavior, were correlated with each other for various intelligence and sex groupings. These data are presented in Table 13. On an a priori basis only certain interview measures were hypothesized to be related to various teacher ratings. Since it was convenient to obtain inter-correlations between all variables on these measures, all correlations are included in the Table. However, only the hypothesized relationships will be discussed. There are forty-five such relationships. Only EMH retardates were included in this part of the study, for reasons given in the Procedures chapter.

Interview Category: School in General.--The interview variable (rated attitudes towards) School in general, was presumed to be related to the teacher ratings of Independence-Dependence, Peer popularity, Organization of verbal material, Memory, Orderliness, and Adaptation to novel situations. The rs between School in General and Independence-Depen -

TABLE 13

PRODUCT MOMENT CORRELATIONS BETWEEN INTERVIEWS ABOUT SCHOOL (CHILD)
AND BEHAVIOR RATINGS (TEACHER)

Interview Variable	Teacher Rating Variable ²	Hypothesized Relationship	EMH		Normal		EMH		Normal		EMH		All		All Subjects N=102
			Normal	Retard	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls			
													N-51	N-53	
1	1	X	.155	.230*	.215	.199	-.144	.376	.206	.131	.194*	.194*	.131	.194*	
1	2		.110	.252*	.071	.254	.612	.208	.173	.266	.194*	.194*	.266	.194*	
1	3		.289*	-.114	.317*	-.130	.198	.020	.068	.078	.410*	.133	.078	.058	
1	4		.066	.189	.049	.051	.094	.622*	.051	.410*	.133	.133	.410*	.133	
1	5		.227*	.350**	.290*	.340*	-.115	.362	.317*	.190	.297**	.105	.190	.297**	
1	6		.059	.147	.046	.020	.102	.575*	.032	.371*	.105	.105	.371*	.105	
1	7		-.108	-.131	-.225	-.155	.390	-.038	-.198	.110	-.122	-.122	.110	-.122	
1	8		-.014	.254*	.062	.394*	-.255	-.192	.236	-.201	.128	.128	-.201	.128	
1	9	X	-.291*	-.371**	-.433**	-.355*	.148	-.464*	-.383	-.233	-.334**	-.334**	-.233	-.334**	
1	10		.032	.074	.114	-.072	-.612*	.510*	.015	.208	.058	.058	.208	.058	
1	11		.002	-.018	.057	-.131	-.301	.386*	-.048	.151	-.010	-.010	.151	-.010	
1	12	X	.188	.004	.170	-.170	.261	.704*	-.023	.456*	.085	.085	.456*	.085	

- 1 1--School in general
2--Teachers
3--Peers
4--Achievement
5--Discipline
- 2 1--Independence-dependence
2--Child's estimate of own ability
3--Child's mood related to adult's behavior
- 2 4--Need for immediate satisfaction
5--Affection from Adult
6--Cooperation-competition
7--Fearfulness
8--Maintains attention on work
9--Peer popularity
10--Activity level
11--"Emotional" (temper) behavior
12--Organization of verbal materia
13--Vocabulary & language use
14--Communication with others
- 15--Memory
16--Peer domination or submission
17--Orderliness
18--Adaptation to novel situations

TABLE 13 (Continued)

Interview Variable1	Teacher Rating Variable2	Hypothesized Relationship	Teacher										All Subjects N=104
			Normal N=51	EMH Retard N=53	Normal Boys N=39	EMH Boys N=40	Normal Girls N=12	EMH Girls N=13	All Boys N=29	All Girls N=25			
1	13		-.063	-.161	.037	-.097	-.390	-.418*	-.032	-.358*	-.105		
1	14		-.017	-.142	.086	.217	-.240	-.154	.150	-.184	.078		
1	15	X	-.011	-.135	.108	-.053	-.432	-.443*	.032	-.403*	-.045		
1	16		.010	.081	.023	-.013	-.204	.415*	.001	.274	.053		
1	17	X	.263*	-.175	.229	-.230	.471*	-.104	-.052	.021	-.016		
1	18	X	-.031	.042	.088	.047	-.589*	.051	.068	-.182	.009		
2	1	X	.182	.150	.210	.122	.089	.357	.166	.153	.164		
2	2	X	.236*	.021	.230	.078	.001	-.077	.145	-.107	.110		
2	3		.135	-.150	.205	-.156	-.141	-.278	.012	-.093	-.023		
2	4	X	.210	.286*	.245	.075	-.114	.710**	.169	.441*	.243**		
2	5	X	-.157	.157	-.191	.284*	-.118	-.092	.057	-.170	.017		
2	6		.178	.166	.177	-.041	.146	.702**	.066	.512**	.173		
2	7	X	.210	-.130	.206	-.222	.060	.098	-.017	.182	.033		
2	8		.122	.068	.103	.260*	.365	-.374	.184	-.163	.089		
2	9	X	-.178	-.277*	-.209	-.260*	-.182	-.298	-.229	-.290	-.238**		
2	10		.144	.091	.106	.035	.084	.206	.078	.196	.108		
2	11	X	.206	.057	.233	.049	.000	.031	.134	.094	.120		
2	12		.097	.021	.163	-.131	-.142	.465	.000	.234	.058		
2	13		.188	-.064	.158	-.049	.398	-.106	.062	-.008	.044		
2	14	X	.050	-.020	-.008	.031	.432	-.187	.010	.046	.016		
2	15	X	.375**	.135	.353	.276*	.449	-.188	.320*	.042	.249**		
2	16		.150	-.022	.083	-.137	.834**	.293	-.044	.374*	.043		
2	17	X	.127	.012	.060	-.003	-.096	.118	.015	.130	.059		
2	18		-.097	.009	-.061	.014	-.072	-.031	-.015	-.138	-.050		
3	1	X	-.022	.044	.046	.018	-.484	-.023	.032	-.280	.006		
3	2		.092	.230	.086	-.055	-.071	.160	.016	.074	.056		
3	3		.166	-.113	.087	-.122	.590*	.553*	-.023	.512**	.023		
3	4		.184	.016	.144	.131	.331	-.228	.097	.051	.083		

TABLE 13 (Continued)

Interview Variable 1	Teacher Rating Variable 2	Hypothesized Relationship	Normal		Exam		Normal		Exam		Normal		Exam		Normal		Exam		Normal		Exam		All	
			N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33	N=31	R=33
3	5		-.083	.345*	-.022	.193	-.644**	.232	.088	-.185	.081													
3	6		-.023	-.146	-.134	-.143	-.602*	.172	-.130	.217	-.073													
3	7		.134	.058	.083	.037	.318	.346	.073	.385*	.122													
3	8		.023	.147	.083	.163	-.163	.106	.113	-.046	.082													
3	9		-.132	-.328*	-.136	-.272*	-.192	-.421	-.220	-.285	-.203*													
3	10		.223	-.012	.281*	.034	-.444	-.136	.119	-.224	.078													
3	11		.348	-.068	.118	-.036	.448	.021	.027	.196	.038													
3	12		.243*	-.040	.104	.116	.447	.489**	.040	.317**	.103													
3	13		.135	-.019	-.148	.083	.219	-.048**	.113	-.179	-.118													
3	14		.023	.140	.069	.244	-.063	-.391*	.109	-.345	.050													
3	15		.247*	.142	.242	.193	.282	.338	.162	.036	.173*													
3	16		.053	.353	-.102	-.123	.428	.399	.169	-.136	-.104													
3	17		.073	.186	.036	.106	.598*	.340	.083	.345*	.131													
3	18		-.042	-.089	.030	-.071	-.293	-.134	-.044	-.232	-.093													
4	1		-.046	.031	-.053	.029	-.178	.058	.002	-.121	-.012													
4	2		-.071	.312	.132	.333	.504*	.082	.073	.133	.101													
4	3		.074	.334	.083	-.069	.020	-.223	.010	-.028	-.016													
4	4		.243*	.272*	.216	.312	.308	.348	.195	.321	.319*													
4	5		.119	.022	.084	.074	.363	.386	.021	.312	-.058													
4	6		.031	.226	.034	.218	.149	.351	.070	.076	.073													
4	7		.272*	.109	.259	-.218	.294	.346	.079	.331	.136													
4	8		.057	.009	.010	-.113	.244	.334	-.046	.069	-.050													
4	9		.020	-.113	.029	-.294*	.063	.385	.175	.145														
4	10		.048	.072	.012	.220	-.600	.370	.043	-.283	-.017													
4	11		.172	-.020	.197	.116	-.089	-.460	-.044	-.191	-.096													
4	12		.104	.130	.054	-.231	.242	.155	-.059	.223	.002													
4	13		.134	.160	-.210	.132	.009	.217	.103	.047	-.048													
4	14		-.078	.117	-.126	.231	.189	-.415	.003	-.015	-.004													
4	15		-.059	-.089	-.002	.102	-.276	.334	-.003	-.243	-.046													

dence ratings vary from $-.14$ (normal girls) to $.37$ (EMH girls), with the remaining $\bar{r}$ s clustered from $.13$ to $.23$. Except for the female retarded and normals, then, only a slight positive relationship exists between these variables. There is a stronger relationship between EMH girls' attitudes towards school in general and their rated independence-behavior in the school situation than for other groups.

Significant and fairly strong inverse relationships were noted for all groups except normal girls between attitudes towards school and their rated peer popularity. Since the teacher scale was constructed so that low scores represent "high popularity", we conclude that by and large teachers' ratings of children's attention in school are significantly correlated with the children's rated popularity. No cause-effect relationships were determined for these variables.

Significant $\bar{r}$ s were determined between attitudes towards school and teachers' ratings of verbal organization (TNS variable 12) and ability to memorize (TNS variable 13). This was particularly true for EMH girls ($\bar{r}$ $.70$ and $-.66$ respectively) and less true for normal girls ($.26$ and $.43$ respectively). The total girls' $\bar{r}$ s were $.43$ and $-.40$, respectively. On the other hand, there were only slight relationships between these variables for both EMH boys ($-.17$ and $-.31$) and normal boys ($.17$ and $.11$). Consequently, the total EMH and normal $\bar{r}$ s and combined $\bar{r}$ were relatively low for these variables. No significant differences in $\bar{r}$ s between the retarded and normal groups were noted.

$\bar{r}$ s between School in General and ratings of Obedience clustered around $.30$ for the combined total groups, all retarded and all normals. Scores of both girl and boy normals, however correlated significantly on these variables (girls $.47$, boys $.22$, total normals

.26). These variables were negatively correlated for all EMH groups. Significant differences between these intelligence groups occurred on this variable.

There were no ρ s of note between attitudes towards school and teachers' ratings of the child's ability to adapt to new situations, except for normal girls. Although the Table presents a ρ of -.59 for this group, the scale was constructed so that low scores meant "good adaptation". Consequently, the normal girls can be thought to be different from EMH girls and all boys in terms of the relationship between their attitudes towards school and their rated adaptability. This may reflect a real sex difference, although the normal girl $\bar{M}$ was very small.

Interview Category: Teachers.--There were ten teacher ratings hypothesized to be related to the interview variable, attitudes towards Teachers (hereafter Teachers). There were low positive ρ s between the Teachers category and rated Independence for all groups except female retarded. The ρ for this group was .36 and it is significant at the .25 level. Only this group demonstrated any concordance between attitudes towards their teachers and their teachers' ratings of their dependency behaviors.

Only the total normal group, due principally to normal boys, demonstrated significantly related ratings on the Teacher interview category and teachers' ratings of child's own estimate of ability (TMS variable 5). ρ s for normal girls and all retarded children were not significant.

Significant ρ s between the Teacher category and the child's rated need for immediate satisfaction (TMS variable 4) were noted for the combined total ρ s, all girls, retarded girls, all retarded ρ s. These

r s seem primarily related to a very high r (.71) between these variables for IDH girls. While normal boys' scores also showed some relationship (r .24), the normal girls r was low (-.11). Apparently, IDH girls ratings of teachers correspond well with those of other boys and girls subgroups. Therefore, the total r , though significant, seems somewhat spuriously high.

There seems to be little reason to believe that children's attitudes towards teachers are related to their rated desire for affection from adults (TBS variable 3), since none of the r s for the subgroups exceed the range -.19 to .13, except the r for IDH boys, which is .28. The same general conclusion is reached with respect to relationships between these variables, except that both IDH and normal boys' scores correlate in the low .20's, with the IDH boys' scores yielding a negative r . IDH boys' attitudes towards teachers vary inversely with ratings of their desire for adult affection, while normal boys' scores are positively related. It may be that IDH boys are more overt in their behaviors than normal boys in the classroom.

Fairly strong relationships, significant at the .05 level, exist for all groups between all groups' scores on the interview ratings about teachers and the teacher ratings of peer popularity. There are no significant differences between the groups and r s vary from -.18 (all normal) to -.36 (IDH girls). These data suggest a definite relationship between these variables, regardless of sex or intelligence level. It is suggested that children's rated affection for adults may be related to the attitudes that they held toward their peers.

An interesting finding was that only for normal boys was there any r between "emotional" behavior (temper outbursts) and attitudes towards teachers. Even this relationship was not very strong. It had

been presumed that there might be a particularly strong r for some of the retarded children, particularly boys, but this was not the case.

Only the normal girls' r s on the Teacher category and rated Communication with others (TRS variable 14) were large enough to warrant consideration. Because of the low N in this group and the lack of correspondence between the variables for other groups, we conclude that there is no relationship between these variables.

Highly significant r s between the interview category Teachers and rated Memory characteristics were observed for practically all groups. EMH girls' scores co-varied inversely, which caused the total girls' r to be not significant, but both EMH boys and normal boys and normal girls group scores were significantly related at the .05 level or better.

It was interesting to see that there were no significant relationships for any of the groups between scores on the interview Teacher category and the TRS category Orderliness.

Interview Category: Peers.--It was hypothesized that there would be significant r s between the children's attitudes towards peers and ten teacher ratings. So far as the r s between category Peers and ratings of Independence-dependence were concerned, however, only EMH girls' interview scores showed any relationship with the teachers' ratings ($r = .48$). This r affected the total girls' r on these variables. Our conclusion is that, since there were only 12 EMH girls, and since none of the other groups' scores were correlated, the hypothesis should be rejected.

When attitudes towards Peers was correlated in the ratings of Comparison-competition, a sex difference in favor of girls' r s was

noted. Normal girls' scores on these variables demonstrated a high positive relationship (.60). Neither EMH boys' or girls' nor normal boys' scores on these variables were correlated. Consequently, scores for neither total EMH nor normal groups showed correspondence. Apparently, normal girls' reports of their feelings about peers correspond more with teachers' ratings of girls' cooperative-competitive behavior but this is not true for normal boys' scores.

Inverse r s were found for both EMH girls and boys when peer-attitudes and ratings of peer-popularity were compared. The r for EMH girls was $-.42$, for EMH boys $-.28$, for all EMH children $-.24$. The relationships for normal boys and girls were in the same direction but to a lesser degree (girls $r = .19$, boys $r = .14$). These two ratings co-vary more as a function of intelligence level than of sex, according to our data, but none of the r s is high enough to permit prediction.

Prior to testing, it was felt that significant inverse r s would be observed between interview ratings of peers and teachers' ratings of peer popularity (TBS variable 13). Results show that these two variables co-varied more for normals than for retardates, although only the girls' r s were in the expected direction. Normal girls' ratings by teachers do co-vary with their self-reports about peers ($r = .44$) but normal boys' ratings of peer popularity are in the opposite direction from their own expressions about peer-preferences. This may be a function of the age group sampled, since several teachers commented on the "activeness" (with the implication of "rudeness") in boys and this may have affected the teachers' ratings on this variable.

There was little co-variation between scores on the interview category Peers and teacher ratings of the child's activity level, co-

cept for normal girls. For this group there was a significant r of .47, suggesting that this group tends to receive scores ("less active" and "likes peers better") more consonant with each other than other subgroups.

A wide difference between the r s of normal boys and girls was found when the Peers interview category was correlated with ratings of vocabulary and language use, (TNS variable 13). The r for girls was .22, for boys -.25. These mean that normal boys' attitudes towards their peers co-vary inversely with teachers' ratings of their language use, while girls' attitudes co-vary positively. For this age group studied, perhaps this is not surprising. The largest r between all interview and teacher ratings occurred in the retarded girls' groups for these variables. The r -.87 for this group indicates a very high inverse relationship for this group between attitudes towards peers and their rated language use. While the r itself does not suggest cause-effect relationships, analysis of interviews and teacher ratings permits the interpretation that, while the girls express a liking for other children, teachers rate their language use as poor, and this accounts for the high inverse r .

Although neither of the normal groups' scores co-varied on the interview category Peers and teacher rating Communication with others (TNS variable 14), there was a low positive r for these variables for EMH boys (r .18) and a high negative r for EMH girls (r -.38). Apparently EMH boys' reports of their peer relationships are consonant with teachers' ratings of their ability to communicate with others, but just the opposite is true for EMH girls. Since EMH girls were rated very low in this ability, the assumption is that their self-reports about

getting along with others was quite high. We question the reliability of the EMH girls' self-reports, in view of the teacher ratings on TRS variables 13 and 14.

A sex difference in terms of relationships between category Peers and ratings of Memory (variable 15) was noted. Scores of neither EMH nor normal boys were correlated but there was a strong positive r for normal girls (.46) and an almost equally strong negative r for EMH girls (-.40). Both girls' groups' scores suggest they like other children; teachers rate normal girls high on Memory, EMH girls low on this variable. This accounts for the difference in r s between the girls' groups.

Interview Category: Achievement.--It was thought that ten teacher rating variables might be correlated with this interview category. First, r s between this category and ratings of the child's estimate of his own ability (TRS variable 2) were analyzed. Of the subgroups studied, the normal girls showed an r of .50 but the normal boys r was -.13. The retarded girls r was .09 and retarded boys' r was .33. These differences among sex-intelligence groupings caused rather low total sex-group r s. Evidently normal girls' and retarded boys' attitudes towards their school work correspond fairly well with teachers' ratings of their children's estimates of their own abilities, but this is not true for normal boys or EMH girls.

There were consistent positive r s for all subgroups between the interview category Achievement and teacher ratings of desire for immediate satisfactions. Both normal and EMH boys' and girls' self-reports of their attitudes towards school work co-vary somewhat with teachers' ratings of these variable mentioned (r s from .22 to .37 for

these subgroups). There are no significant differences between retardates and normals or between the combined sex groups.

The teacher behavior rating scale category Cooperation-competition correlates with retarded $\bar{x}$ s reports about their school achievement, although this is not true for normals. The scores of both EMH boys and girls indicate that, as a group, they demonstrate less competitive behavior than the groups of normal children and this probably accounts for higher $\bar{x}$ s.

Interview category Achievement scores and TRS scores on Fearfulness yielded $\bar{x}$ s for EMH and normal girls of .37 and .29, respectively, and for normal boys .26. The $\bar{x}$ for EMH boys is -.22. The $\bar{x}$ s for girls as a sex group is .33, while the directional difference in the boys groups minimized the combined boys' $\bar{x}$ (.00).

Ability to attend to work (TRS variable 10) was presumed to be related to the child's stated attitudes towards school work. The $\bar{x}$ s for the girls' groups suggest confirmation of this hypothesis (EMH girls $\bar{x}$ -.37, normal girls -.40). Inverse $\bar{x}$ s occur because low scores represent greater "attention". There was a very low $\bar{x}$ between these variables for normal boys and the $\bar{x}$ for EMH boys was low but positive (.22). The sex differences are probably due to the fact that teachers rated girls as "more attentive" than boys.

The $\bar{x}$ s between Achievement and ratings of Organization of verbal material (TRS variable 12) for both girls' groups and normal boys are too low to be considered significant, although all $\bar{x}$ s are positive. The $\bar{x}$ for EMH boys approaches a meaningful value (.08 level) but it represents an inverse relationship (-.33). These boys are rated to have greater difficulty in organizing their ideas in verbal pre-

sentation and this probably accounts for the differences in r_s between them and the other groups.

Although normal boys' scores on Achievement and teacher ratings of Vocabulary and language use co-varied in the expected direction ($-.21$), the r for normal girls ($.01$) suggests little relationship between these variables for this group. The ratings of vocabulary of most EMH boys and girls were higher than ("not as good as") those of normals and this probably accounts for the positive r_s for these groups ($.15$ for boys, $.33$ for girls). That such differences in r_s should occur between the intelligence groupings is not unexpected.

Since the r_s for EMH girls and normal girls ($-.15$ and $-.27$ respectively) are too low to be significant because of the small N_s in these groups, and since r for both boys' groups cluster around zero, we conclude that there are no relationships between Achievement self-ratings and teachers' ratings of Memory (TRS variable 15).

An interesting difference in r_s between EMH and normal children, particularly the girls subgroups, occurred when Achievement and Orderliness (TRS variable 17) were compared. The retarded girls' scores on these variables were correlated highly ($.52$) and the boys' r_s were in the same direction but lower ($.18$). Neither of the normal subgroup scores co-varied significantly. We conclude that these characteristics are more highly related for retarded than for normal children because teachers rate EMH children, particularly, as being less concerned with orderliness and these ratings co-vary with the children's own lower estimates of their school work. This is particularly true for EMH girls.

The relatively firm relationships between Achievement scores

and teacher ratings of adaptability (TRS variable 18) for normal children (-.40 for girls, -.16 for boys and -.21 for all normals), indicates that these children, particularly the girls, are rated as able to adapt to new situations more easily than retarded children. Their higher scores ("more positive feelings") in the Achievement category contribute to the negative r_s . There are no significant r_s between these variables for the retarded children.

Interview Category: Discipline.--Seven teacher rating categories were presumed to be related to this interview category. The first r_s analyzed were those between Discipline and ratings of Independence-dependence. Although no significant r_s were noted for any of the subgroups, the retarded boys' scores indicate a tendency to co-vary (r -.27) and contribute heavily to the combined EMH group r of -.22. Our impression is that self-reports about discipline do not correlate with teachers' ratings of independence behavior.

Comparatively high r_s were found between Discipline and ratings of "Child's mood related to child's behavior" (TRS variable 3), particularly for the girls' groups. The retarded girls r of .69 indicates that the "high" teacher ratings of this characteristic (i.e. relatively little behavior change as a function of praise or reprimand) co-vary directly with their comparatively low Achievement scores. On the other hand, normal girls seem to be much more affected by the teachers' behavior, so there is an inverse relationship between their Discipline scores and ratings (-.36). From the low but positive r_s for both boys' groups (.20 normals, .22 EMH) it is concluded that self-reported attitudes towards Discipline are related more to teachers ratings of relative lack of reaction than to adults' motivational

techniques.

Normal boys' and girls' scores in Discipline and ratings of "Need for (immediate satisfaction)" correlate at a low positive level (.21 and .25, respectively) but neither r is statistically significant. Retarded girls' scores co-vary inversely, suggesting that their lower ratings by teachers correspond with their self-reports of satisfaction with school discipline. It does not appear that the r s between these categories contribute very much to our knowledge about children's school behavior.

Positive r s were found between Discipline and teacher ratings of desires for adult affection for both girls' groups (EMH r .36, normal r .22). The normal boys' r also was low but positive (.18), while no relationship between EMH boys' scores was ascertained. The r s suggest a tendency for all the girls and the normal boys to demonstrate positive or negative attitudes towards school discipline which correspond with teachers' ratings of their affection-seeking behavior. However, none of the r s is significant beyond the .05 level.

It was expected that there would be fairly strong r s between Discipline and teachers' ratings of "temper" behavior (TR3 variable 11). However, r s for all groups were very low (none was above .16) and so this hypothesis is rejected.

A sex-difference in terms of r s of between Discipline and ratings of Peer domination or submission (TR3 variable 16) was noted. Both EMH and normal girls scores co-varied, but in opposite directions. The retarded girls were rated as more submissive, normal girls more dominant, in peer behavior but their self-reports about discipline were highly similar. Therefore, the normal girls r of .40 indicates

both positive self-reports and teacher ratings while the OMI girls $\bar{r} = .28$ represents low ratings on the Teacher Rating Scale. Neither of the boys' group scores demonstrated any degree of correlation on these variables.

Both normal and OMI girls were rated to be somewhat "slow" in adapting to novel situations (IMS variable 18) and the scores of both groups on the IMS correlate inversely with Discipline self-ratings (normal $\bar{r} = .45$, OMI $\bar{r} = .28$). However, neither of the boys' groups showed any significant co-variation in scores on these variables.

Summarizing, most of the data obtained from the interview about school do not seem to be highly correlated with the selected teacher ratings of children's behavior. Some modest but genuine correlations and a few strong $\bar{r}$ s were found between different categories of the two measures, but the majority of correlations were not significant. These results are in agreement with those found by Halpern and Tyler (1970) in their attempt to validate an incomplete sentence test.

CHAPTER 10

SUMMARY

This section of the research deals with the measures employed by the clinical psychologist and his assistants¹ to compare retarded and normal children's intelligence, personal-social behavior, school behavior, and health status. It was hypothesized that there would be significant differences between retarded and normal children not only in intelligence, as measured by the WISC (retarded) and CTNN (normal), and Brown's Progression Metrics (1914 edition), but also in (1) Personal-social behavior, measured by the Gurwitsky Motor Development Scale (GMS) (Lincoln revision): Children's Manifest Anxiety Scale; and extensive case history including data about each child's family, home, neighborhood culture, and developmental data; the Draw-A-Person technique; and, the Vineland Social Maturity Scale; and (2) School behavior, measured by a structured interview administered to each child attending school, and a behavior rating scale completed by the child's teacher. A health examination was given each GMS retarded child by a pediatrician but it was not possible to get such examinations of institutionalized retarded children and normal controls. *t*-tests were run to determine if significant differences occur between institutionalized and non-institutionalized (GMS) retardates on these measures.

¹The principal investigator would like to acknowledge the help of Donald Brown, Sylvia Mack, Donald Hake, and Mrs. Emma Pritchett in administering and scoring these measures.

Partial correlations were run between measures of intelligence, social responsiveness, emotional stability, and anxiety for all the population groupings. Product-moment correlations were run to determine the extent to which mother's ratings and children's behavior data about school re-entry. The case history, Draw-A-Person technique and health status data were not suitable for conventional analysis, and were analyzed in terms of percentages or raw score data.

Results indicate that retarded children differ significantly from normals on all the measures employed in this part of the investigation, with the exception of those relating to school behavior. This suggests that retarded children, both mildly mentally handicapped and institutionalized, are inferior to normal children not only in terms of intellectual considerations but also in terms of motor proficiency, in self-reported freedom from "anxiety", in a variety of familial, cultural and developmental considerations indicated by the case history, in the tendency to include some (but not many) features in their figure-drawings which have been presumed to represent "maladjustment", and in social maturity (DRE children only). Standard health considerations available for DRE children suggest the presence of more health anomalies for this group than is typical for normal children but these data cannot be considered conclusive.

Significant relationships between both IQ and IQ, as measures of intelligence, and measures of reasoning ability (Progressive Matrices) and motor proficiency (Gesellschaft Motor Development Scale) were determined for all retarded IQs and normal IQs, and for most subgroups of both major groupings according to sex; however, no significant relationships between measures of intelligence and anxiety (Children's Manifest An-

(any boys) were determined. In addition, no relationships between measures of intelligence and social maturity (Maudsley Social Maturity Scale) were determined. These latter findings are different from those reported by other investigators for normal children (13) and retarded children (14).

Relatively few significant correlations were found for either retardation or normals when the various personal-social measures were compared with each other.

Major but genuine relationships between teacher ratings of children's behavior in school and the children's rated attitudes towards school were determined for both normal and IRE retardates. Sex differences among normals favoring girls and among retardates favoring girls were noted in many of the relationships between school measures.

Scores of institutionalized retardates were differentiated from those of IRE retardates on measures of intelligence (IRE slightly higher mean IQ due to boys' scores) and "anxiety" (Lincoln school group "more anxious" due to boys' scores) and on certain aspects of the case history and Draw-A-Person test. No differences between these groups were found on the Progressive Matrices and the Gesell-Meyer Development Scale. Data suggest that there are little or no differences between IRE and institutionalized girls but that the IRE boys tend to get higher scores than institutionalized boys on practically all measures. This suggests definite differences in abilities of IRE children which may be attributable to sex. It is possible that girls are not placed in IRE rooms unless they are more notably retarded than boys in many aspects of behavior.

Finally, our experience with and data about the Progressive

Bayley (1913 edition), Gesell's Motor Development Scale, and Childen's Wechsler Anxiety Scale, some of which has been used extensively with retarded children (especially DSM boys and girls), suggests that these instruments yield valuable data about retardation and on occasion could use for both clinical and research purposes.

CHILDREN'S ANXIETY SCALE

Name: _____ Grade: _____ Sex: _____
 Age: _____ I-Score: _____ School: _____

Read each question carefully. Put a circle around the word Yes if you think it is true about you. Put a circle around the word No if you think it is not true about you.

- Yes No 1. It is hard for me to keep my mind on anything.
- Yes No 2. I get nervous when someone watches me work.
- Yes No 3. I feel I have to be best in everything.
- Yes No 4. I blush easily.
- Yes No 5. I like everyone I know.
- Yes No 6. I notice my heart beats very fast sometimes.
- Yes No 7. At times I feel like shouting.
- Yes No 8. I wish I could be very far away from here.
- Yes No 9. Others seem to do things easier than I can.
- Yes No 10. I would rather win than lose in a game.
- Yes No 11. I am secretly afraid of a lot of things.
- Yes No 12. I feel that other- is not like the way I do things.
- Yes No 13. I feel alone even when there are people around me.
- Yes No 14. I have trouble making up my mind.
- Yes No 15. I get nervous when things do not go the right way for me.
- Yes No 16. I worry most of the time.
- Yes No 17. I am always kind.
- Yes No 18. I worry about what my parents will say to me.
- Yes No 19. Often I have trouble getting my breath.
- Yes No 20. I get angry easily.
- Yes No 21. I always have good manners.
- Yes No 22. My hands feel sweaty.

- Yes No 22. I have to go to the toilet more than most people.
- Yes No 23. Other children are happier than I.
- Yes No 24. I worry about what other people think about me.
- Yes No 25. I have trouble swallowing.
- Yes No 26. I have worried about things that did not really make any difference later.
- Yes No 27. My feelings get hurt easily.
- Yes No 28. I worry about doing the right things.
- Yes No 29. I am always good.
- Yes No 30. I worry about what is going to happen.
- Yes No 31. It is hard for me to go to sleep at night.
- Yes No 32. I worry about how well I am doing in school.
- Yes No 33. I am always nice to everyone.
- Yes No 34. My feelings get hurt easily when I am scolded.
- Yes No 35. I tell the truth every single time.
- Yes No 36. I often get lonesome when I am with people.
- Yes No 37. I feel someone will tell me I do things the wrong way.
- Yes No 38. I am afraid of the dark.
- Yes No 39. It is hard for me to keep my mind on my school work.
- Yes No 40. I never get angry.
- Yes No 41. Often I feel sick in my stomach.
- Yes No 42. I worry when I go to bed at night.
- Yes No 43. I often do things I wish I had never done.
- Yes No 44. I get headaches.
- Yes No 45. I often worry about what could happen to my parents.
- Yes No 46. I never say things I shouldn't.
- Yes No 47. I get tired easily.

Yes No 9. It is good to get high grades in school.

Yes No 10. I have had dreams.

Yes No 11. I am nervous.

Yes No 12. I never lie.

Yes No 13. I often worry about something bad happening to me.

CASE HISTORY FORM

CODE 195

2

4. Name of Child _____

5. Address _____

6. Birthdate _____ 7. Informants _____

8. Report sent to _____ 9. Date _____

10. Examiner _____

1. FAMILY DATA

A.* Constellation.

1. Name 2. Relation 3. Age 4. Educ. 5. Employ. 6. Health

7.* (Evidence; Physical-mental health in family)

8.* Parents Marital Status.

B. Home

1.* Own _____ *Rent _____ 2.* (Amount) _____

3.* (Type)

4.* (Condition)

5.* (No. rooms): Kit. Din. Livg. Rm. Bedrms. Bath

6.* Child's roommate.

7.* (Play facilities).

C.*? (Family income)

0-2000
21-3500

36-5000
51-6500

66-8000
80-10,000

10,000+

D.* (Family spending)

1. Food
2. Clothing
3. Home expenses
4. Utilities
5. Automobile (s)
6. TV _____ Radio _____ Record Player _____ Combina. _____
7. Entertainment
 - a. Social visiting
 - b. Recreational
 - c. Travel

E. Neighborhood.

1. Community size:

Rural _____	3000-5000 _____	15000-25000 _____
0-1500 _____	5000-7500 _____	
1500-3000 _____	7500-15000 _____	

Cultural Patterns of Neighborhood.

2. Ethnic group.
3. Socio-economy of families.
4. Age of family gps.
- 5.* Children in neighborhood.

2. DEVELOPMENTAL DATA

- A.* Pre-natal
- | | Yes | No |
|--------------------------|------------------------|------------------|
| 1. Planned | _____ | _____ |
| 2. Sex Preference | _____ | _____ |
| 3. Mother's cond.: | Morning Sickness _____ | Fatigue _____ |
| | Illness _____ | Work _____ |
| | Accident _____ | |
| 4. Mother's Attitude: | Strongly wanted _____ | Not wanted _____ |
| 5. Father's Attitude: | Strongly wanted _____ | Not wanted _____ |
| 6. Gestation: | Full Term _____ | Premature _____ |
| 7. Previous Pregnancies: | Live births: _____ | |
| | Miscarriages: _____ | |

B.* Delivery

1. Hours in labor _____ 2. Precipitate _____ Delayed _____
3. Where born: Hospital _____ Home _____ Other _____
4. Delivered By: Physician _____ Midwife _____ Other _____
5. Instruments: _____
6. Anesthesia: _____ Time Under _____

Attitudes towards delivery:

7. Mother: Negative _____ Positive _____
8. Father: Negative _____ Positive _____
9. Any abnormalities in delivery: _____
10. Health of Child: _____
11. Birth weight: _____

C. Post-Natal**Feeding:**

1. Schedule _____ Self-demand _____
2. Breast _____ Bottle _____
3. Weaning (age in months): _____
4. Food preferences: _____

5. Typical diet:**Motor Development:**

- | | Age: | Comments: |
|--------------------|-------|-----------|
| 6. Creeping | _____ | _____ |
| 7. Walking | _____ | _____ |
| 8. Hand preference | _____ | _____ |

OSERETSKY TEST SCORES: ATTACHED**Toilet training:**

- | | Age: | Comments: |
|--------------------------|-------|-----------|
| 9. Defecatory: Began | _____ | _____ |
| Completed | _____ | _____ |
| 10. Urinary: Began | _____ | _____ |
| Completed | _____ | _____ |
| 11. Cathartics | _____ | _____ |
| 12. (Parent's Reaction:) | _____ | _____ |

D. Communication:

- | | Age: | Comments: |
|-------------------|-------|-----------|
| 13. First words | _____ | _____ |
| 14. First phrases | _____ | _____ |

ARTICULATION REPORT ATTACHED

E. Sensory Development.

Vision Report Attached

Audition Report Attached

F. Sexual Development:

Age: _____

Comments:

15. Masturbatory _____

16. (Parents Reaction)

17. Puberal signs

3. EDUCATIONAL-INTELLECTUAL DATA

A. School

1. Present grade _____

2. Child's reaction to school _____
Strongly likes Str. dislikes

3.* Parent's estimate of child's reaction:

4. Teacher's estimate of child's reaction (see attached scale).

5. Special interest activities: Opportunity Participation:

Art:	_____	_____
Music:	_____	_____
Sports:	_____	_____
Clubs:	_____	_____

ACHIEVEMENT RECORD ATTACHED.
ACHIEVEMENT TEST SCORES ATTACHED.

B. School history:

1. Age re: School _____

2. Grade _____

3. Reactions of child.

4. Reactions of parent.

GENERAL SCHOOL RECORD ATTACHED.

5. Special Educational Training:

Type Agency	Age Began	Completed	Child's reactions.
-------------	-----------	-----------	--------------------

C. Intellectual Status.

1. Intelligence Test Scorer.

Date Given:

Binet IQ

Wisc: FS

VS

PS

Raven's Matrices

Vineland SQ:

Other:

2.* Parent's estimate of intelligence.

Superior _____

Average _____

Slow _____

Bright _____

Very Slow _____

3. Teacher's estimate of intelligence.

Superior _____

Average _____

Slow _____

Bright _____

Very Slow _____

HOME FACILITIES RELATING TO INTELLECTUAL FACTORS.

Read by Parents, Parents to Child, Read by Child.

4.* Books:

Fiction

History

Biography

5.* Magazines:

Current Events

Popular

Comics

Scientific

6.* Newspapers: Daily
Weekly

7.* Music, Art in home.

*Neighborhood facilities: Available Used by family By Child.

8. Library

9. Museum

10. Other

4. HEALTH HISTORY

- | | No Difficulty | Defect (Explain) | Age |
|---|---------------|------------------|-----|
| 1. Pre-natal condition
(toxins, diseases) | | | |
| 2. Natal factors (see 2) | | | |
| 3. Post-natal factors.
(injuries, diseases, accidents) | | | |
| 4. Stigmata | | | |
| Cosmetic | | | |
| Sensory | | | |
| Orthopedic | | | |
| 5.* Parental Reaction to: | | | |
| 1. Prenatal | | | |
| 2. Natal | | | |
| 3. Postnatal | | | |
| 4. Stigmata | | | |
| 6. Child's reaction. | | | |
| 1. Prenatal | | | |
| 2. Natal | | | |
| 3. Postnatal | | | |
| 4. Stigmata | | | |

MEDICAL RECORD ATTACHED.

Draw-A-Person Test

The purpose of the test is to obtain two drawing samples from the child; one drawing is to be of a person his own sex (presumably a self-concept drawing) and one of a person the opposite sex from the child. Our experience has been that the drawings probably will not be as valuable in differentiating retarded children from their normal controls as will be the stories which the children tell about the drawings. The stories will be rated on a point-scale similar to that used for the Structured Interview.

Be sure to have the child draw a whole person. If he draws a picture only of the head, either leave the original piece of paper there and ask him to "Draw the rest of him", or give him a new sheet and say, "That was fine - Now I'd like you to draw me a whole person - his head, body, arms and legs."

Use one sheet for each drawing. Indicate with an arrow the parts drawn first - last.

Write the story the child tells you about his figure on the same sheet as the drawing. Be sure to put the child's name on the sheets; have him print his own name if he can.

Administration Directions:

1. Place a sheet of white typewriter paper on the table in front of S and say, "Draw me the picture of a person, will you?" Ordinarily, the child will look questioningly at you, or say something; in this case, simply smile and repeat.
2. If the child raises specific questions regarding what part of a person, "Who?" the person should be, the sex, age, etc., or if he asks what size it should be, or the like, indicate that he should draw a whole person but that it can be any person he likes. (See above)
3. If the S draws a person of the same sex as himself, say, when he is finished: "That's fine. Now tell me a story about this person. Any kind of story will do - but tell me a story about the person you have just drawn". If the child demurs or is silent, coach him by first asking. "How old is this person?" Then, "Is it a boy (man) or girl (woman)?" Then, "What is he doing -- thinking about -- Tell me all about him". If the child still has difficulty, then ask; "What does this person like? What does he not like? You can tell me a story about that." Be sure to include the positive and negative aspects of the question together.
4. If the child draws first a person of the opposite sex, wait until he has made both drawings before you ask for the story. Ask about the person of the same sex first.

Structured Interview: General Directions

The purpose of the interview is to obtain rateable responses from the children. There are six areas that are to be covered in the interview - attitudes about the School in General, about Teachers and Staff, about Peers, about School Achievement, about Discipline, and about Activities. The responses should be written down verbatim, using whatever shorthand method you can.

Insofar as possible, do not introduce any question which implies a value-judgment on your part; questions should be open-ended and neutral in tone. Many retarded children are non-verbal and will have to be encouraged with smiles, repetitions of questions, and statements like "I know you can tell me a fine idea about ____".

If a child begins talking about an area other than the one you have directed your questions toward, follow his lead and discuss that area; then come back later to the area he skipped over. Mark each section carefully so raters will be able to tell which area is being covered by your questions.

Illustrative questions:

School in General: Q--"Tell me something about your school here--I'd like to know what you think of your school." If silence or purely descriptive statements ensue (e.g. "There are lots of buildings here"), follow up with something like this: "Can you tell me more? How do you feel about your school here (or, the Lincoln School)". If very short answers are still given, you might try, "That's fine. Now can you tell me some of the things you like and don't like about the school?"

Teachers and Staff: "Tell me something about the people who work here (or, your teachers--the people who hold classes for you, etc.)" Then, if necessary, "Fine. Can you tell me more--what are they like?" Finally, "What do they do that you like? What do they do that you don't like?" (The last-name should be used only when no other statement evokes a value-judgment answer.)

Peers: "What are the kids here at Lincoln like?" How do you get along with the children here -- How do the kids treat you -- How do you treat the other kids? -- Do you like the other kids here? Why? -- Do the other kids like you? Why?" We are particularly anxious to get responses that can be evaluated in terms of adequacy of interpersonal relations.

Achievement: "Do you go to school here (or, have classes here)? Tell me about them..." If no value judgments are given, or if you want to get the child to elaborate, say "That's very interesting -- can you tell me how you feel about them?" or the like. We want to get some estimate of whether the child does participate in some kind of training (class, farm, etc.) and what his estimate of his ability is, together with an idea of whether he likes or dislikes it and how much of either.

Activities: What has been described for Achievement can be applied to Activities. See if he participates with other children or adults.

Discipline: The idea here is to get some estimate of the child about his own behavior and the behavior of other children; also, we want to know how he feels about the methods used by personnel to maintain discipline. The following questions might get at this; "How do the other kids in your class usually behave? How do they get along with each other? -- What happens when kids don't do things they are asked to do? Does this happen very much? -- Do any of the kids ever get into trouble here? -- Do you ever get into trouble? -- What does the attendant (teacher) do when kids get into trouble?" and the like. This is a very difficult area not to prejudice and care must be taken to phrase questions so that the child is asked not only about the negative aspects of discipline.

STRUCTURED INTERVIEW RATINGS

General Scoring Criteria

All clinical interviews are to be rated on a 7-point scale for each of the relevant variables. In order to provide a comparable basis for the ratings an attempt has been made to list appropriate descriptive material concerning each of the criteria under each rating scale number listed below.

The important variable to be rated in each instance is the continuum between a psychologically healthy attitude or relationship and a psychologically unhealthy one. Healthy attitudes are thought to be positive, realistic attitudes expressing feelings of liking for people, school, activities, etc., interest in these things, and participation in activities; it may also mean a feeling of being liked and accepted by others, or a feeling of adequacy. On the other hand, unhealthy attitudes represent negative and/or unrealistic attitudes, expressing feelings of dislike, disinterest, lack of participation, or feelings of hostility, defiance, conflict, overconformity, withdrawal, inadequacy, or of being disliked or not accepted by others. Examples given or specific acts mentioned are included below for illustrative purposes.

Rating	Response
0	Spontaneity revealing high interest and/or participation in school activities, work, interpersonal relationships; feels realistically competent and indicates healthy outgoingness (but not to extreme); feels genuinely liked and not simply because of special abilities or possessions; positive attitude towards grades as an aid to learning; genuine liking for teachers and peers as people; real liking for school and school work.
1-2	Positive with qualifying aspects; respect (as opposed to liking) for others; realistic attitudes towards regulations and rules; some interest and/or participation in activities; liking for school qualified, or some indication of rejections of other positive aspects of life (ex: doesn't like vacations).
3	Neutral attitude; positive and negative comments which cancel out each other; purely descriptive and irrelevant comments.
4-5	Negative comments but less intense than 6's or with some positive aspects; overconforming behavior; inadequacy and inferiority feelings; achievement solely to please others; little interest and/or participation in school activities; evasiveness about feelings during interview indicating an attempt to cover up real feelings.
6	Open hostility, sullenness; marked defeatism and social isolation; active dislike and opposition to teachers, peers, regulations, school, etc., particularly when apparently unfounded; outright dislike for all subjects, assignments, or other aspects of school work.

SCORING MANUAL (A)

Interview Ratings --- School, General¹

- 0 - I like it very much - even wish we had it on Saturdays and Sundays; we have lots of fun in school and learn a lot, too; school is just fine.
- 1 - I like school - it means a lot to me - I get to learn a lot; we have a good school and I like it - its better than other schools around here;
- 2 - Its okay - pretty good - we have good school here; school provides us with something to learn - I like it most of the time; I like it -- it depends on the teacher (kids, work, etc); I've like it this year more than last year - the subjects are more interesting, although I don't like Social Studies (math, etc.); I like it - when there's no school there's nothing to do - we have a big playground (gym, etc.) and we play ball every day;
- 3 - Sometimes it's ok and sometimes it's not, it all depends; Our school is a big old red brick building, and we go every day (elaborated)
- 4 - Its not so hot here - they have a nice gym and its ok but the teachers and kids are mean - its ok, I guess; its not such a hot school -- its old (no play place, or the like);
- 5 - Its not so bad as some other place - its better than nothing; I don't like it - its boring and you never learn anything;
- 6 - I hate it! We never can do anything we want, and the teachers are always after you; its awful -- we never do anything and its never any fun;

¹These are sample responses copied exactly as written by the children.

SCORING MANUAL (B)

Interview Ratings - Teachers¹

- 0 - My teacher is real nice - she helps us a lot and we all like her; Mr. (Miss, Mrs.) _____ is swell - everybody likes him (her); I like them - they think of lots of things for us to do that are fun; She's the best teacher in the school!;
- 1 - I like my teacher a lot - she treats us good; she is always doing nice things for us so I like her; she's one of the nicest teachers in the school; I like most of them - they can teach and make you want to learn;
- 2 - He really teaches us a lot - he's strict, but he makes us learn; I like most of them - they usually treat us pretty good; most teachers here are ok.
- 3 - Her (his) name is _____ and she lives in _____; She is an older teacher - she even taught my father here -- I like her some of the time and some of the time I don't; I like them when they're nice and I don't like them when they aren't.
- 4 - She's ok I guess, but I've had better ones; She is pretty strict with us, and we don't have much fun in class; we fool her a lot and she doesn't know the difference; some teachers are ok.
- 5 - Some teachers are ok, but most of them don't know what they're doing - they let us get away with a lot and don't teach us anything; They do a lot of beating around the bush and make it long, dull and boring; They get mad too easily - they yell at you or hit you sometimes - I don't like that.
- 6 - Teachers are stupid (jerks, etc.) - I don't like them; I don't like the teachers here, they're mean and don't do anything to help you;

¹These are sample responses copied exactly as written by the children.

SCORING MANUAL (C)

Interview Ratings -- Peers¹

- 0 - They're nice -- I just like to be with them -- they like to play and do most of the things I do;
- 1 - I like practically all of them -- they're fun, even boys (girls) are fun but sometimes they're rough (if girls or boys referred to as snobs are something as strong or stronger, reduce to 2).
- 2 - They're ok - we get along fairly well - guess they like me, I like them of; My friends are at my speed - some kids want to be big shots, but most of the kids are pretty nice; (from a preadolescent) I like the boys, but I don't like the girls 'cause they don't play baseball, and the boys do;
- 3 - Some are nice and some are not - some I like and some I don't; There are 34 in my class -- I like them when they're nice and I don't like them when they're not;
- 4 -
- 5 - Some are snobs and cuss - the few others are ok; you can show them things; Girls (boys) are nice in a sense - they don't tease us; I don't like many of them kids in my room - too bossy (mean, etc.) They're a bunch of screwballs;
- 6 - The kids in my room are mean - try to boss me around and they never act nice;

¹ These are sample responses copied exactly as written by the children.

SCORING MANUAL (D)

Interview Ratings - Achievement¹

- 0 - My subjects are fine - I do good in them; I like all my subjects and I learn a lot in school - its fun;
- 1 - I learn a lot in this school - we do interesting things, its ok; I like it here, the subjects are interesting.
- 2 - My school work is easy - I get good grades in English and Math, but not too good in Science; I like most of my subjects, but I don't like Math and gym;
- 3 - I do about average work in our class - get along alright, I guess; I have arithmetic, spelling, geography (etc. - simply listing subjects); we do a lot of work in school - I like some of it and some of it I don't.
- 4 - I do ok in music and arithmetic, but not so good in the others - they aren't so easy; its alright (work) but I don't get such good grades; its alright (school work) but I don't like the subjects they teach - they ought to have more science (social studies, gym, etc.);
- 5 - Most of the time I don't do so good - they don't learn you anything here and I can't understand the subjects; they don't need math and science and I don't like social studies - its a waste of time; I don't do so bad but I don't like the subjects;
- 6 - I don't like my school work - its too boring -- its too hard and boring; I can't do this work - I can't understand what they're talking about;

¹These are sample responses copied exactly as written by the children.

SCORING MANUAL (E)

Interview Ratings - Discipline¹

- 0 - It suits me to a T - everything in our class is ok;
- 1 - We get along fine in our room - everybody like everybody else and the teacher is real nice about it;
- 2 - It's ok - you can't be good all the time, but mostly I am; our class is ok - some of the kids are rowdy, but mostly we do ok;
- 3- It's very important because we get grades on it -- average for me; Depends on the situation - sometimes we're good and sometimes we're bad - about the only thing wrong we do is talk - not much, really;
- 4 - We hardly ever get into trouble - its never too bad in our class nothing ever goes wrong in our class (laughs); sometimes we're pretty hard to control - some kids won't pay attention or they talk and pass notes; kids shouldn't do the things they do - pass notes and whisper- the teacher talks to them or sends them to the principal;
- 5 -Our class is sometimes bad - they throw paperwads and things like that anytime the teacher's gone; whenever the teacher goes out of the room - watch out! - they go wild; we get away with talking and there is hardly any discipline - the teacher doesn't know how to handle us at all; when we're bad she talks to us or sends us to the principals's office - get whipped - don't like that; most kids don't behave very well and nobody pays much attention to the teacher - we don't get caught very often (laughs)
- 6 - Our class is always fooling around and the teacher doesn't do anything about it - kids are just that way, I guess; we get away with anything - the kids don't care what they do; there isn't any discipline in our class, the kids are always talking (Laughing, etc.)

¹These are sample responses copied exactly as written by the children.

TEACHER'S BEHAVIOR RATING SCALE

To the Rater:

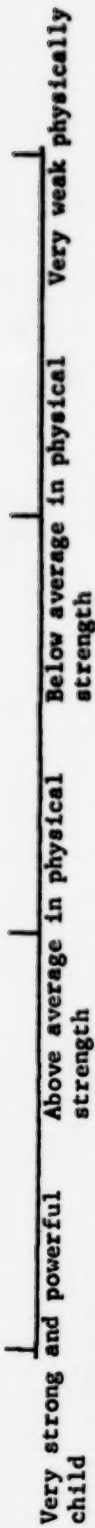
This scale is given to you in the hope that we can get to know this child better. We have tried to include only those characteristics that the classroom teacher might be expected to observe.

You should place a check along the line at that position which most adequately describes this child on the particular characteristic. If you feel that a behavior description describes the child's behavior exactly, place the check on the mark above the statement. Otherwise, the check can be placed anywhere along the line, at the point closest to a particular statement or between two statements.

Each characteristic is divided into four positions to help guide you to a more precise judgment. It is not necessary that you check directly on those positions although you may.

Example:

Physical Strength



Date _____ Children's Rating Scale Name of Child _____
 Rater _____

Almost always want to do task for self. Gets upset if help is offered. Proud of own ability.	Tries to do most tasks by self. Occasionally requests help from adult.	Sometimes wants to work on task without help. Often asks for help and assistance from adult.	Rarely attempts to do things by self. Requests almost constant help.
--	--	--	--

Grossly overestimates own abilities. Thinks he (she) can do many things that are impossible for self.	Generally overestimates abilities but not markedly so. Generally can adjust goals downward by experiencing failure.	Generally underestimates abilities but not markedly so. Can generally adjust goals upward by experiencing success.	Grossly underestimates self abilities. Continually insists that he (she) cannot do things that are really within his ability range.
---	---	--	---

Mood of child depends to great degree upon adult attitudes. Greatly affected by adult's praise or criticism.	Mood and behavior of child sometimes can be influenced by adult. Other times no observable effect.	Reprimands or praise may temporarily effect mood and behavior of child. Child usually quickly reverts to original patterns of behavior.	Neither praise or reprimands seem to have any observable effect upon the behavior or attitudes of this child.
--	--	---	---

Shows marked inability to postpone present satisfaction for future reward, in most situations.	Generally wants things here and now. Impatient about delays. Can sometimes wait if encouraged.	Generally can be expected to wait for rewards if encouraged to do so. Sometimes wants immediate satisfaction.	Can be counted on to delay satisfaction if expected to do so, in most situations.
Fairly self-sufficient as far as needs for affection are concerned. Rarely indicates such need to adult.	Needs affection when difficult situations arise. Otherwise does not seek out affection of adult.	Child will need much affection when frustration and disappointments arise. Can usually get along without it when things go well.	Child shows strong and constant need from adult under almost all conditions.
Must be first in everything, get biggest share, etc. Fierce competitor.	Occasionally will share, take turns, etc. Most often wants to be first in everything.	Occasionally competes with others for top status, generally not motivated to compete.	Content to be with group, not motivated by competitive tasks.
Extremely fearful child. Seems frightened of almost everything. Easily startled.	A child who periodically shows fearful behavior. Easily upset.	Occasionally shows fearful behavior. Usually comfortable and secure.	Rarely shows any fearful behavior. Almost always happy or at ease.

The child is able to maintain attention upon task at hand, Sticks to task until finished in most situations.	Occasionally distracted by events around him. Sometimes will not finish task.	Easily distracted from work. Usually does not finish task in most situations.	Almost never able to concentrate for more than a very few minutes. Hardly ever finishes task.
One of the most popular children. Gets along with everyone.	Well liked by others. Able to get along with most other children.	Has one or two friends. Generally ignored or not well liked by other children.	Has no close friends. Is either ignored or actively disliked by others.
Child seems to have boundless energy. Moving all the time. Very difficult to settle down.	Generally an active child. Can be settled down with some effort.	Generally a quiet child who seldom becomes overactive.	A quiet child who seems to be sluggish and is hard to arouse to any sustained activity.
Child tends to lose temper under the slightest stress. Keeps nothing within him. Almost always shows emotions.	A child who generally shows emotional behavior. Usually tends to express his feelings openly.	Occasionally shows emotional behavior. Usually tends to control emotions.	Almost never shows emotional behavior. Tends to keep feelings within him.

Finds great difficulty in organizing events in a logical sequence when speaking.	Has some difficulty in verbally reporting events in their regular order.	Usually is able to verbally report events in their logical order.	Almost always gives events in the correct order when speaking.
Child has very good use of language. Uses difficult words often.	Use of language is generally good. Sometimes uses difficult words.	At times runs into difficulty in using words. Usually uses simple words.	Uses few and simple words. Difficult to learn new words.
Child is able to communicate with others with little difficulty. Speech is good; talks easily.	Generally able to communicate with others, although finds it difficult under some situations. Speech intelligible and meaningful that sometimes spoken to. is reticent.	Usually has difficulty in communicating with others. Some speech trouble. Usually speaks only when	Almost unable to communicate with others in most situations. Speech difficult; unintelligible and meaningless.
Has great ease at remembering past events. Eager to memorize things.	Generally is able to recall things that happened in the past. Shows some interest in memory work.	Occasionally can remember past events, but has some difficulty in doing so. Little interest in memory work.	Finds it very difficult to remember things. Is not interested in memorizing things.

Child must get his own way in almost all situations. Tends to dominate other children.	Generally tends to want his own way. Gets upset if others do not go along with him.	Child will tend to follow other children, but finds it difficult to lead others.	Almost always dominated by other children. Cannot seem to assert his own desires.
--	---	--	---

Child doesn't seem to care if things are out of place. Doesn't put things back in order.	Generally tends to leave things as they are. Only puts back things in order if they are extremely out of place.	Usually bothered if he (she) sees anything that is in disorder. Tends to put things back in order.	Gets very upset if he (she) sees disordered things. Spends great time in putting things back in order.
--	---	--	--

Adapts quickly to new situations. Not upset by new people or new routines.	Accepts new situations fairly well; sometimes upset by new people or routines.	Usually slow to adapt to new situations typically somewhat unsettled by new people or routines.	Upset by new people or situations; has difficulty in adapting.
--	--	---	--

PHYSICAL EXAMINATION

Name _____
Address _____

Wetzel Grid Status _____
Isodevelopmental Level _____
Channel _____
Auxodrome _____

Height _____
Weight _____
Blood Pressure _____
Pulse _____

General Appearance: Bright _____ Average _____ Dull _____

Posture: Good _____ Fair _____ Scoliosis _____ Kyphosis _____
Lordosis _____

Gait: Normal _____ Abnormal _____ Description: _____

Skin: Normal _____ Dry _____ Moist _____ Rash _____

Lymph nodes:

Anterior Cervical:	Normal _____	Enlarged _____
Posterior Cervical:	Normal _____	Enlarged _____
Axillary:	Normal _____	Enlarged _____
Inguinal:	Normal _____	Enlarged _____

Head: Symmetrical _____ Asymmetrical _____
Hydrocephaly _____ Macrocephaly _____ Microcephaly _____
Brachycephaly (Broad Head) _____
Oxycephaly (Tower Head) _____
Scaphocephaly (Long Narrow Head) _____

Hair: Fine _____ Coarse _____ Dry _____

Eyes: Nystagmus _____ Strabismus _____ Exophthalmus _____ Enophthalmus _____
Conjunctiva: Clear _____ Injected _____
Sclera: Clear _____ Injected _____ Jaundice _____

Ears: Drums: Normal _____ Injected _____ Dull _____ Perforation _____
Pinna: Normal shape _____ Deformed _____

Nose: Open _____ Edema _____ Discharge _____

Throat:

Tonsils: Present _____ Absent _____ Enlarged _____ Scarred _____
Infected _____
Pharynx: Clear _____ Injected _____ Edema _____

Neck: Supple _____ Resistent to flexion _____

Thyroid: Palpable _____ Not palpable _____

Chest: Clear _____ Rhonchi _____ Wheezing _____

Heart: Normal _____ Enlarged _____ Murmurs _____ Type and location: _____

Name _____
Address _____

Hernia: Present _____ Absent _____ Location: _____

Abdomen:

Liver: Normal _____ Enlarged _____
Spleen: Normal _____ Enlarged _____
Masses: Present _____ Absent _____ Location _____ Type _____
Tenderness: Present _____ Absent _____ Location _____
Rigidity: Present _____ Absent _____ Location _____

Genitalia: Normal Male _____ Anomalies _____ Describe _____
Normal Female _____ Anomalies _____ Describe _____

Extremities: Movement Symmetrical _____
Movement Limited _____ Extremity (ies) _____
Paralysis _____ Extremity (ies) _____

Neurological: (when Indicated)

Reflexes:

	<u>Right</u>	<u>Left</u>
Patellar:	_____	_____
Achilles:	_____	_____
Abdominal:	_____	_____
Biceps:	_____	_____
Supinators:	_____	_____
Cremasteric:	_____	_____

Kernigs: Present _____ Absent _____
Brudzinski: Present _____ Absent _____
Babinski: Present _____ Absent _____
Romberg: Present _____ Absent _____

Cranial Nerves:	Normal	Abnormal
I. Olfactory (Smell)	_____	_____
II. Optic (Sight)	_____	_____
III. Oculomotor (Loss of pupil movement; Eye turned outward.)	_____	_____
IV. Trochlear (Eye turned up and in)	_____	_____
V. Trigeminal (Mastication)	_____	_____
VI. Abducens (Internal strabismus)	_____	_____
VII. Facial (Wrinkling forehead; closing lips)	_____	_____
VIII. Auditory (Hearing)	_____	_____
IX. Glossopharyngeal (Difficulty swallowing; Control of palate)	_____	_____
X. Vagus (Vocal chords)	_____	_____
XI. Spinal Accessory (Shrugging shoulders; Rotating head)	_____	_____
XII. Hypoglossal (Tongue deviation)	_____	_____

Comment:

Homer H. Hanson, M.D.

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SECTION II

**PERCEPTUAL AND RESPONSE ABILITIES OF MENTALLY RETARDED CHILDREN
AS MEASURED BY SEVERAL AUDITORY THRESHOLD TESTS**

By

Chester J. Atkinson, Ph.D.

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ABSTRACT

The literature in the area of testing the hearing of the mentally retarded is to date in unanimous agreement that there is greater incidence of Hearing Loss among the mentally retarded than among normal populations. The percentage of Ss exhibiting significant Hearing Loss is to an extent a function of two procedural variables; the test and indicator used to assay hearing potential, and the criteria selected to define significant Hearing Loss.

Two major objectives of the project were: (1) to get a comparable measure of Hearing Loss on institutionalized mentally retarded children, non-institutionalized mentally retarded children, and a control group, (2) to obtain these measures by several test procedures. These test procedures varied with regard to the response used to indicate hearing, the rationale being that the sensory processes of the mentally retarded child are essentially the same from test to test and that variations in the Hearing Loss measures are a function of the test and of the response indicator used. The tests from which data are reported are: (1) Standard Audiometer test, (2) Eye-Puff test, (3) Four-Choice Forced-Choice, (4) Békésy test. Each of these tests required a distinctly different response to indicate hearing.

The data also indicate there is not a greater percentage of significant Hearing Loss among the mentally retarded tested than among a comparable normal group.

This study was facilitated by the use of a mobile research unit, a large truck with an enclosed body into which were fitted three sound-isolated cubicles.

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CHAPTER I

INTRODUCTION

Testing the hearing of young children is in general a difficult field. The difficulties arise from many sources, part of them within the machinery involved in hearing tests and part of the reaction of the child to the testing situation. Nevertheless, the bibliography associated with the testing of the hearing of young people is formidable in size.

In the specific field of testing the hearing of mentally retarded children, there is a drastic reduction in the size of the bibliographical material and there appears to be great variance among estimates of Hearing Loss in the mentally retarded population. This variance and presumably the lack of bibliographical size are due to the above factors regarding the normal children plus a confounding series of factors. Three factors may be enumerated briefly. The first is the suitability of the criterion of "correct response" that the child should make to a test stimulus. Second, there is always the doubt that instructions are comprehended. Third, there is a question of whether or not the child remembers the agreed upon signals. At least these three factors must be taken into account when attempting to assess the reliability and validity of tests designed to assay the hearing potential of mentally retarded children.

The effects of Hearing Loss and the effects of mental retardation can be rather similar in several respects, but the educational process

is different for the two types of children. Hardy (1948) concluded that a reasonably good hearing test needs to be differential at least between those children who appear to be mentally retarded through Hearing Loss and those who are genuinely mentally retarded.

The usual method of determining whether a person hears a tone or not is the performance of a response agreed upon between the audiometrist and the person being tested. Frequently this indicator of hearing is simply the raising of the finger while the tone is on, and depression of the finger when the tone is off. If these finger movements coincide with the presence and absence of the stimulus (usually a tone), then the operator has some confidence that in fact the person did hear the tone. The choice of this indicator of hearing has been to a large extent an arbitrary convenience, rather than a reasoned choice among indicators.

It was felt that some of the Hearing Loss reported in the literature, particularly for mentally retarded children, might be due to a poor choice of indicator of perception. That is, perhaps the children did not understand, or could not coordinate digit movement, or failed to remember the instruction, "Raise your finger when you hear a tone; put it down when you no longer hear the tone." It was felt that various kinds of tests of thresholds of hearing might serve as a better guide as to the suitability of the tests and the indicators of perception of these tests. Such tests and indicators might uncover hearing in MRs that would have been undetected by standard tests and by standard indicators.

Accordingly, several auditory tests of threshold were assembled and given trial. An effort was made to see that the tests were somewhat the same in that all would be tests of threshold of tones, and different in that each would require different responses (indicators of

perception). For a complete statement of the similarities and differences among the tests and the responses, see the Procedure Section.

It was anticipated that there would be some differences in tests and in responses that would recommend one procedure over another. In general, the rationale was that if a child could hear the tone of X frequency at Y intensity for one kind of test and indicator, that he would be able to hear a like tone on a different test. However, he may have been unable or unwilling to make a like judgment on a different test with a different indicator.

The motivation for undertaking the present study can be stated in several ways. The most succinct way is probably this: (a) there was a population of mentally retarded children in the area, and (b) the coincident interest of several staff members seemed to be in terms of a study of the perception and response capabilities of MR children similar to this one.

CHAPTER II

REVIEW OF LITERATURE

As was stated earlier, the literature specific to the testing of the hearing of the MIs is rather small. The presentation of the reports of testing MI children that follow present an available sampling of that literature.

Burt (1937) reported on the incidence of Hearing Loss among the "normal" and "backward" school children in London and Birmingham. In the normal population, he reported one per cent presented "marked" Hearing Losses and approximately 10 per cent "slight" Hearing Losses. In the backward population, six per cent exhibited "marked" Hearing Losses and approximately 15 per cent "slight" Hearing Losses.

Abernathy (1938) reported the testing of pure-tone thresholds for children with IQs ranging from 20 to 69. The CIs of these Ss ranged from seven to 20 years. Children with ear pathologies were excluded. There were 373 Ss included in the analysis. The following frequencies were tested: 64, 128, 256, 512, 1024, 2048, 4096, and 8192. Thresholds were reported in "sensation units." The median thresholds were reported to be 10 to 20 "sensation units" less sensitive than audiometric zero.

A report on the incidence and degree of Hearing Loss among institutionalized mental retardates was made by Birch and Matthews (1950). Their report was based on 274 Ss with CIs ranging from 10 to 19 years. Only Ss with MIs of five years or more were used. A pure-tone audiometer was used for the testing. The indicator of hearing was a

hand-raising response. If this was not feasible, the subject was encouraged to use a verbal indicator; if this failed, the subject was dismissed. A sweepcheck testing method was employed. The sweep was made at 15 db. If this intensity was not responded to, the stimulus was increased to an intensity at which accurate responses were obtained. The results obtained by classifying the data according to a criterion (failure to pass a 15 db sweepcheck) showed that 50 per cent of the population exhibited some loss; 32 per cent, severe loss.

MacPherson, (1952) by questionnaire procedures, attempted to assay the extent to which schools of the mentally retarded considered their patients to be deaf or hard-of-hearing. The returned questionnaires indicated that the schools considered 50 per cent of their patients to possess hearing defects of some nature.

Schlanger (1953) investigated the incidence of Hearing Loss in a private school for the mentally handicapped. Seventy-four children were tested. The mean CA was 12 years one month, and the mean MA was six years eight months. Pure-tone audiometric testing was done following a procedure similar to that employed by Birch and Matthews. Hearing loss was computed on the basis of a formula recommended by the American Medical Association. An A. M. A. percentage under 96 but not lower than 90 was defined as a "slight" loss; less than 90 per cent but not lower than 55 per cent was considered a "moderate" loss. Percentages below 55 per cent were defined as a "severe" loss. Hearing Loss, as defined, was indicated in approximately 30 per cent of the total group. Fourteen per cent were included in the moderate and severe categories.

In England, Foale and Paterson (1954) tested the hearing of a group of mentally retarded who also exhibited behavior problems. The CAs of these 32 ranged from 10 to 19 years. The mean IQ was reported

as 66. One hundred Ss were tested by pure-tone audiometric procedure. The sound was presented at 10 db. If a response was not obtained, intensity was raised until accurate responses were obtained. Hearing Loss was defined as not responding to one or more of the test tones above 20 db. The authors reported that 13 per cent of the population would probably be handicapped in ordinary life situations.

Another investigation which was designed to assess an incidence of Hearing Loss of institutionalized mentally retarded children was done by Johnston and Farrell (1954). Two hundred and seventy children were given pure-tone hearing tests. Children who had a 20 db or more loss in two or more frequencies were retested a week later. A discrete frequency audiogram covering 250 cycles through 6,000 cycles was used. Twenty-four per cent of these subjects showed significant Hearing Losses, approximately five times that of Massachusetts public school children of similar age. A sex difference was noted; boys tended to have more Hearing Loss than girls.

Bradley, Evans and Worthington (1955) reported investigation of the relationship between administration time for audiometric testing and mental age of mentally retarded children. A factor of interest to the present report is that the workers divided their population into IQ groups, 30 to 50 and 50 to 79. Thresholds were determined at 250, 500, 1,000, 2,000, 4,000, and 8,000 cps. The tone was presented first at 30 db to one ear and then to the other. If audible, the level was decreased in 10 db steps until the subject no longer indicated hearing the tone. Threshold was defined as the lowest intensity at which the subject gave three consecutive responses. Of the 60 children tested, 43 per cent of the high group (IQs 50-79) had Hearing Losses; 47 per cent of the low group (IQs 30-50) had Hearing Losses. Hearing Loss was defined as a

loss of 20 db or greater at two frequencies.

Schlanger and Gottsleben (1956) reported the results of hearing tests for 498 Ss at The Vineland Training School. The mean CA was 28.9 years and mean MA was seven years eight months. The frequencies of 500 to 4,000 cps were tested in each ear beginning at 1,000 and proceeding to 4,000, rechecking 1,000 and then testing 500 cps. The standard audiometric procedure was modified by having a training period for the hand signal and by presenting before the test a 50 db tone at 250, 1,000 and 3,000 cps. If the hand signal could not be appropriately trained, a verbal response was tried. Thirty-five per cent of the population were classified as "normal" hearers; 14 per cent as having "slight" losses; 28 per cent as having "moderate" losses; six per cent were classified as "hard-of-hearing"; and one per cent as "deaf". Seventeen per cent of the population were classified as not testable. The non-testable children usually had a MA below five years.

The most recent investigation of Hearing Loss among the mentally retarded was reported by Kodman (1958). His 208 Ss were selected from the Kentucky Training Home, an institutional school for mentally retarded children and adults. The population was divided into two groups on the basis of age. The Young Group ranged in age from seven to 19 years with a mean age of 15.4 years. The Old Group ranged in age from 20 to 64 years with a mean age of 33.7 years. Of the 208 Ss, 189 were testable by the procedures employed. The average MA of the Young Group was 6.8 years; the average MA of the Old Group was 6.4 years. MA was assessed by means of the Stanford-Binet and Wechsler-Bellevue IQ tests. Individual pure-tone audiometry was used throughout. Each subject was screened at 20 db at frequencies between 250 and 3,000 cps. If a subject

failed this screening test, his pure-tone thresholds were then determined for each frequency in either ear. Hearing Loss was defined as a threshold of 30 db or greater at one or more frequency in either ear. By this standard, 19 per cent of the Young Group exhibited Hearing Loss, and 24 per cent of the Old Group exhibited Hearing Loss.

The investigators cited above are in agreement that the mentally retarded population exhibits a greater incidence of Hearing Loss than the non-mentally retarded population. However, the agreement stops at this point. The proportion of Hearing Losses reported ranges from 13 to 49 per cent. This lack of agreement may be understood in terms of several factors. The distribution of CAs, MAs, and IQs varied from report to report. The test procedures while similar to some extent, also varied from study to study. Finally, several criteria were employed to define Hearing Loss. In view of the variations from study to study, it is not surprising that there is considerable range in terms of the proportions of Hearing Loss reported for the mentally retarded.

Part of this literature is perhaps not completely germane to the data of this study. To be more exact, it is seldom possible from the articles cited to find any reassurance that the term "Hearing Loss", has the same meaning from one study to the next. Further it is seldom possible to compare data either among the authors cited or with the data of the present study. The terms "Mentally Retarded," "Educable Mentally Handicapped," and "Hearing Loss" are not strictly parallel in all these reports.

CHAPTER III

STATEMENT OF THE PROBLEM

The main problem was to assemble several tests of hearing, each with its own indicator, and apply these tests to three populations: first, the Institutionalized Mentally Retarded; second, the Non-Institutionalized Mentally Retarded; and third, a Normal "Control" population.

For ease in both writing and reading this report, the following definitions of terms are made. (a) Hearing Loss; the amount of deviation in decibels from a normal audiometric zero Hearing Loss reference line. (a-1) Significant Hearing Loss; a Hearing Loss equal to or greater than a selected criterion. (b) Mentally Retarded Children were defined multidimensionally in terms of their placement in a program designed for the treatment and care of the mentally retarded with an IQ below 80. (c) Institutionalized are those children tested at the Lincoln School and Colony, at Lincoln, Illinois; Non-Institutionalized mentally retarded are those children tested among those who are enrolled in local day schools at the public schools. (d) Controls: those children with normal intelligence who were matched group-wise in terms of age and sex as the control population against which to measure the mentally retarded population.

Objective: The primary objective of this project was to isolate procedures which would most accurately assess the hearing potential of

mentally retarded children. To satisfy this general objective, several sub-objectives were established. A battery of hearing tests, all which reportedly measured thresholds for pure tones were brought together. These tests varied from each other in respect to the manner in which S was required to respond to the tones. Preliminary testing indicated that several of the tests were not feasible for evaluating the hearing potential of mentally retarded children. The feasibility of a test was determined by (a) the ease of determining the validity of the indicator (response), (b) appropriateness of the indicator, i.e. can a mentally retarded child perform the required response, and (c) the time required to administer the test. Tests which did not approximate the criteria were excluded from the battery.

The selected tests were then administered to three groups, Institutionalized Mentally Retarded, the Non-Institutionalized Mentally Retarded, and a matched control group. Assuming the postulate that the hearing mechanism remains essentially the same from test to test, information can thus be gathered which will allow definitive statements regarding the major objectives. It will be possible to comparatively assay the incidence of Hearing Loss in the Institutionalized Mentally Retarded, Non-Institutionalized Mentally Retarded and the Control Group.

Bibliographically, the incidence of Hearing Loss appears to be greater among the mental retardates than comparable normals. Possibly one test may show a greater incidence of Hearing Loss among the mentally retarded than among the normal group. If other tests do not confirm this finding it would seem that the hearing test showing greater Hearing Loss among mentally retarded children is perhaps measuring other factors than hearing. Also it would seem possible to assay which of the test or

tests is the most efficient for use of testing the hearing of mentally retarded children and normal groups.

Using the data from the clinical psychology phases of the subject, it will also be possible to obtain an estimate of the degree of association between the various hearing tests and IQ. Possibly an analysis showing the relationship between the various tests and IQ would yield further information in regard to test selection.

CHAPTER IV

PROCEDURE

General Procedure: Four different audiometric tests were administered to each subject when possible. These tests varied as to the nature of the response required. The Standard audiometric procedure involved use of the finger-raising response as the indicator of hearing; the Eye-Puff Conditioned tests involved a strong blink of the eyes as the indicator of hearing; the Four-Choice Forced-Choice required the subject to choose between four temporal intervals and an associated light in terms of when a tone appeared; and the Békésy test required the subject to press the button as long as he heard a tone and to release this button when he no longer heard the tone. The same tests and procedures were used for the normal population and the mentally retarded population tested. All the testing was done in an air conditioned sound-treated truck which contained three individual testing rooms. Each test was always given in the same room.

Three subjects were taken simultaneously to start a particular half day, and they were rotated among the other rooms as they became available. The Standard test and the Eye-Puff were given from the same audiometer in the first room of the truck. The Forced-Choice was given

in the middle room, and the Békésy was given in the third room. This division was made to balance as closely as possible the testing time in each room.

The fact that these rooms were mounted in a truck was of great value in securing subjects with a minimum amount of effort. As a usual thing, the truck was placed in close approximation to a 220 volt outlet at some school building. Then a heavy duty line was run to the truck from the outlet. This one electrical connection constituted the whole process of becoming set up for the utilization of those students who were at or in the vicinity of the school itself. The enclosed canopy on the back of the truck served as a waiting room for subjects out of one room and ready for the next.

The tests were conducted in a relatively good audiometric environment. The sound isolation provided between rooms was in the order of 25 to 30 db. Furthermore, the four main tests required ear-phones. Not too much interference seemed to transfer from one testing room to the next. The steel shell of the truck body served to isolate fairly well for outside sounds. The inner lining of the truck was approximately two inches of glass wool bounded on the inside by one-fourth inch plywood.

Since the population had to a large extent already been determined by one part of the study, not much time had to be spent in each school facility arranging for specific children. A child could be brought to the truck or taken back to his room in very short periods of time if needed.

The order in which the tests were administered to each subject was varied. Preliminary to any testing, the Ss were simply told that

they were about to have their hearing tested. Instructions specific to each test were given before the administration of that test, rather than a lot of general instructions beforehand.

At the onset of each test the S was told he would receive either pennies or gum when he did well on the test. He was then asked which he preferred and items of this type were given to him throughout the test period when his responses were accurate, rapid, and clearly distinguishable. Generally, the presentation of these rewards was most frequent at the beginning of the test period. While no formal control was run as a check on the effect of this addition to the test procedures, the examiners agreed that the reinforcements helped to achieve in most cases cooperative behavior on the children's part.

SUBJECTS: The testing was done with the mentally retarded populations of Herrin, Christopher, Murphysboro, and Marion, Illinois, who attended the classes for Educable Mentally Handicapped in these cities. A comparable control population of normals was also tested in each of these towns. A sample of Institutionalized Mental Retardates was tested at Lincoln State School and Colony, Lincoln, Illinois. The control for this group was obtained in Carbondale, Illinois.

A total of 110 mental retardates and 77 controls was tested. Of the mentally retarded group, approximately half was institutionalized and half was non-institutionalized. The ages of the retarded group ranged from eight to 16 years. The control group was comparable to the mentally retarded groups in terms of age and sex. The IQs of the mentally retarded groups ranged from 46 to 80. The IQs of the normal group ranged from 82 to 144.

SPECIFIC TESTS ADMINISTERED: The instructions and procedures utilized for each test will be described individually. Thresholds were obtained for each ear for each test at 500, 1,000, 2,000, 3,000, and 4,000 cps. Order in which ears were tested was systematically varied for each subject for each test. The apparatus used will be described in a subsequent subsection.

A. **Standard Audiometric Procedure:** The instructions for the Standard Audiometric Procedure were, "Raise your thumb when you hear the tone for as long as you hear it." A test tone was then presented well above average threshold. If the S did not respond in the specified manner, the instructions were repeated. When the subject responded three successive times to an audible tone in the appropriate manner, the test was begun. The test tone was set at an intensity of -10 db and increased in intensity until the subject responded by raising a digit. Intensity was then decreased in 10 db steps. The criteria for decreasing the intensity were three successive responses which were accurate. When the subject's threshold was passed, that is, when he was no longer accurate, the intensity set was then elevated in 3 db steps until the subject again became accurate. At this point a descending series was again initiated, and the threshold was again crossed. In this manner an intensity setting was established at which the subject was accurate and 3 db below which he was not accurate. If the instructions were not followed with an "audible" tone, or the subject persisted in frequent responses in the absence of a tone, the test procedure was discontinued.

B. **Eye-Puff Test:** The pre-test instructions to the subject were, "Each tone you hear may be followed by a puff of air in the eye."

A tone was then presented and followed by a puff of air directed at the eye. The subject was then told that he could avoid the puff of air if he closed his eye as soon as he heard the tone and kept it tightly closed as long as he heard it. The ascending, descending procedures describing the Standard test were employed, the eye-blink response being substituted for the finger-raising response. (For a fuller exposition, see Appendix A)

C. Four-Choice Force-Choice Test: The subject was seated before a panel which contained four lights with a switch adjacent to each. The instructions were, "These lights will come on one at a time, a tone will appear with one of the lights, press the switch by the light where you hear the tone." The four lights were then successively lit with a tone paired with one of the lights. Three test trials were made with an "audible" tone. If the subject was accurate on these presentations, the test procedure was initiated; if the subject was not accurate, he was re-instructed and given three more presentations. If after four instructional periods the subject still did not respond accurately to an audible tone, he was reported as not testable by this procedure.

The test procedure involved presenting the test tone at an intensity of 20 or 25 db. The subject was permitted three trials at each intensity setting. If he was accurate in two out of the three trials, the intensity was decreased 10 db and he was given three more presentations. Procedure continued in this manner, decreasing in 10 db steps until the subject was no longer accurate. Intensity was then increased in 5 db steps until the subject was again accurate. These ascending, descending procedures were continued until a point was

established at which the subject was accurate and 1 db below which he was not accurate. This point was defined as threshold.

D. *Sliding Test*: The special instrument used with sliding type thresholds was a recording attenuator. This attenuator decreases intensity as long as a button is depressed. Intensity will increase when the button is not pressed. The subject was instructed to depress the button for as long as he heard the tone; when he no longer heard it, to release the button. By continuing this process of pressing and releasing the button, a threshold area can be defined. To define threshold, a straight line was drawn through the recordings of successive settings for each frequency.

The preceding tests constitute the data which will appear in the results section. Other tests that were tried but not reported for various procedural difficulties follow.

E. *Localization*: A semicircle of small loudspeakers was constructed on a wooden wall. There were 11 loudspeakers in the half circle. Various frequencies of pure tones and square wave stimuli were presented through one of these loudspeakers. The job for the listener was to turn a switch below the loudspeaker from which he assumed the tone or square wave came. If he was correct, a signal light was extinguished. If he was not correct, he continued turning switches until the light was extinguished. Goodness of judgment was made in terms of how many switches he had to throw to extinguish the light. The results of this test are not here reported because of some anomalies which will be discussed later.

F. *PHN Instrument*: This was a comparison conditioning test. The subject was exposed to a Grass-Bradley PHN unit and regular AM

testing procedures were initiated. The subject was conditioned to expect a shock to be associated with a tone. After conditioning had been established, the level of these tones was reduced until the threshold was determined. The results of this test also are not reported here because of difficulty in establishing stable, reliable, or valid thresholds, and because many children cried when given a mild shock. This test was conducted on only a few Ss. The above mentioned difficulties plus the time factor precluded this test for many subjects.

6. *Conditioned Eye-Puff*: This test differed from 5 in that the eye-puff was presumably to have been conditioned in respondent conditioning techniques; that is, the puff of air became associated with the presentation of the tone so that the expectation was that the subject could hear a tone and blink without verbal instructions to do so. This test, like the GSR reported above, was difficult to administer and difficult to judge when a correct eye-blink occurred. This test, like the GSR, very often resulted in disruptive behavior on the part of the Ss. Therefore, it was eliminated from the battery of tests after a few trials, and no data from these tests are reported.

7. *Fluxion (Flutter) of Interrupted Tones*: It was of interest to investigate the intervals and rates at which sound could be interrupted and still appear to be an interrupted sound.

Interval timers were available which were capable of interrupting sound for intervals as short as one tenth of a millisecond. The recurrence of the on-off cycles could be varied from one millisecond to 13 seconds. Preliminary investigation with several Ss indicated the problem was limited by another factor, this being the rise-decay function designed to eliminate the audible transient noise (pop) which is

present at the on-set and off-set of a tone. The rise-decay time necessary to prevent an audible pop from occurring with the tone used (60 db./hr) was approximately 30 milliseconds. The experimental information obtained indicated the subjects were able to detect sound interruption intervals which were shorter than the restricting rise-decay time. An alternative of using the interrupted sound with the audible pops was not feasible because continuous sound does not exhibit this characteristic. In the face of these difficulties this test was abandoned.

CHAPTER V

APPARATUS

For the Standard test and the Eye-Puff Conditioning test the same Helson 13-A audiometer was used. The difference between these two tests was the utilization of the eye-puff apparatus which was suspended from the head gear. This eye-puff apparatus consisted of a bent piece of copper tubing, a clamp to fasten this tubing securely to the head band of the audiometer, and a long flexible rubber tubing with a bulb at the end of this tube.

The Pavlov-Rubin test utilized a Helson 13-A audiometer to supply the frequencies at the proper intensities to the four-choice panel previously described. In addition to these four lights and switches, the experimenter had at his panel a series of push buttons which controlled the phase and timing of the onset of the light which was associated with the tone. He also turned the tone off and on. These buttons were pressed sequentially by the experimenter.

In the essential parts, the Hickey test type audiometer consisted of an oscillator, audio-frequency; and attenuator, fixed; and a variable recording attenuator described in some detail earlier.

Localization. Besides the 21 small loudspeakers in the semi-circle, there were an oscillator, audio-frequency; an attenuator, variable; and a selector panel from which the experimenter could select any particular loudspeaker to be energized.

The GEL (test F above) apparatus consisted essentially of a shocking device, a timing device for the shock, a delay time which controlled the time between the onset of the tone and the onset of the shock, and a stimulus selector which either allowed or failed to pass a pure tone from an associated ID-A Beltone Audiometer.

The apparatus for the Conditioned Eye-Puff test (G above) was the same as that for F above.

All of the testing was done in a mobile research laboratory which in this case consisted of a large truck with an enclosed steel body, inside of which were constructed three small cubicles separated from each other by walls which were acoustically isolated to a considerable extent. There was a narrow hallway past two of the rooms leading to a third room. There was also provided an air conditioner, plus dust work, to keep the rooms cool during the hot weather. The tailgate of the truck could be opened to form a canopy, giving an additional seating space and waiting room of approximately four by eight feet. All the experimental gear was run from a voltage stabilizer.

Calibration and Scoring

All the audiometers used in the study were calibrated through an artificial ear (Allison) before and after the study. No significant change or deviation from standard calibrations was noted. Because of the difficulties presented earlier in the procedure about the use and calibration of the localization and flutter experiments, no calibration

procedures were instituted. The Standard test, the Eye-Puff conditioning test, the Forced-Choice test, and the Bárány test were all scored in db relative to normal hearing as defined in the standard literature, audiometric zero.

Analysis Procedures

In general, the procedures for the analysis of the data are dictated by the objectives stated previously. That is, a comparison of the hearing ability among three groups: Institutionalized Mentally Retarded, Non-Institutionalized Mentally Retarded and a matched control group. These groups were compared in terms of four test procedures. Each test procedure was designed to establish pure-tone thresholds. The tests each utilized a different type of response as its hearing indicator. Comparison of the data for the groups was achieved by casting the test thresholds into tables having several criteria for Hearing Loss. These comparisons were made in terms of the proportions of each group that fall into the various criteria levels.

The data was classified according to two criterion procedures. One criteria is best described as a general indicator of Hearing Loss. The second criteria procedure was specific in terms of Hearing Loss for speech. The general criteria defines Hearing Loss in terms of the number of pure-tone thresholds that reach or exceed a stated intensity value. For example, a S may be said to have a significant Hearing Loss if two or more frequencies reach or exceed the intensity value of 20 db. The criterion of Hearing Loss for Speech considers only the three frequencies in the immediate speech area (100, 1,000, and 2,000 cps). If the average of these three frequencies reach or exceed a stated value (20 or 30 db) the S is said to have a Hearing Loss for Speech. A

modification of this procedure considers the average of the best two out of these three frequencies (300, 1,000, and 2,000 cps). Again the S is defined as having a Hearing Loss for Speech if the average reaches or exceeds a stated intensity value (20 or 30 db).

Another objective was to assay the relation between hearing potential as measured by the various test procedures and IQ. To accomplish this each S's score for each hearing test was paired with his IQ and a Pearson r correlation was run. The resulting r 's yield estimates of the degree of association between the various test measures and IQ. Totals for each test were used on the assumption that this value best represented S's Threshold for the various frequencies.

Results and Discussion

Two major objectives of the project were: (1) to get a comparable measure of Hearing Loss on institutionalized mentally retarded children, non-institutionalized mentally retarded children, and a control group; (2) to obtain these measures by several test procedures. These test procedures varied with regard to the response used to indicate hearing, the rationale being that the sensory processes of the mentally retarded child are essentially the same from test to test and that variations in the hearing loss measures that occur are a function of the test and of the response indicator used. The tests were (1) Standard Audiometer test, (2) Eye-Puff test, (3) Four-Choice Free-Choice, (4) Mäsky test. Each of these tests required a distinctly different response to indicate hearing.

The literature in the area of testing the hearing of the mentally retarded is to date in unanimous agreement that there is greater incidence of hearing loss among the mentally retarded than among normal

populations. Data will be shown in this section which indicates the percentage of Ss exhibiting significant Hearing Loss is to an extent a function of two procedural variables; the test and indicator used to assay hearing potential, and the criteria selected to define significant Hearing Loss. The data also indicate there is not a greater percentage of significant Hearing Loss among the mentally retarded tested than among a comparable normal group.

The criteria used to define significant Hearing Loss by previous workers varied. However, the most common method is to state criteria in terms of the number of frequencies which exhibited a greater loss than some intensity value. Rodman (1958) defined significant Hearing Loss as at least 20 db or more at one frequency in either ear. Johnston and Farwell (1954) used the criterion of 20 db or more loss in two or more frequencies in the same ear. Foale and Patterson (1954) defined significant Hearing Loss as loss equal to or greater than 20 db in one of the tested frequencies. To date there is no definitive data available to indicate which of the many criteria of Hearing Loss can best predict social or economic adequacy. Because of these factors, it was decided to classify the obtained Hearing Loss data by several criteria, thus permitting inspection of several facets of Hearing Loss.

Accepting the postulate that the hearing potential of a given subject remains relatively constant from one test procedure to another, it appeared logical to select the hearing test for each subject that yields the least amount of Hearing Loss as the best estimate of his true hearing potential. Table 1 and Table 2 are a breakdown by groups and Hearing Loss criteria for each S's best test. Data concerning the S's better ear are displayed in Table 1, while in Table 2 the data for

TABLE 1

DISTRIBUTION OF SUBJECTS BY GROUP THAT REACHED THE GIVEN CRITERIA FOR THE TEST SHOWING THE LEAST AMOUNT OF HEARING LOSS. ONLY THE EAR THAT SHOWED THE LEAST AMOUNT OF HEARING LOSS WAS CONSIDERED.

Criteria	Control	Non-Institutionalized	Institutionalized
2 frequencies 30 db	0	1	0
1 " 30 db	0	0	0
2 " 20 db	0	0	0
1 " 20 db	0	0	0
2 " 10 db	2	1	6
1 " 10 db	0	3	7
2 " 0 db	30	39	32
1 " 0 db	14	8	3
2 " -10 db	14	5	1
1 " -10 db	11	2	1
Total Number Tested	77	59	50

TABLE 2

DISTRIBUTION OF SUBJECTS BY GROUPS THAT REACHED A GIVEN CRITERIA FOR THE TEST SHOWING THE LEAST AMOUNT OF HEARING LOSS. THE SUBJECTS EAR THAT SHOWED THE GREATEST AMOUNT OF HEARING LOSS WAS CONSIDERED.

Criteria		Control	Non-Institutionalized	Institutionalized
2	frequencies 30 db	0	1	0
1	" 30 db	0	0	0
2	" 20 db	2	0	0
1	" 20 db	0	2	0
2	" 10 db	1	6	13
1	" 10 db	3	17	13
2	" 0 db	43	29	18
1	" 0 db	10	1	3
2	" -10 db	10	3	0
1	" -10 db	8	0	0
Total Number Tested		77	59	30

the poorer ear are displayed.

One article in the field reports using as a criterion for significant Hearing Loss one frequency at or above 20 db. This criterion required less actual loss to be considered significant than other investigators used. Applying this criterion to the three groups in Table 1, it can be seen that the proportions among those groups exhibiting significant Hearing Loss are similar. For the ear showing the least amount of Hearing Loss the proportions were: Control (0 out of 77), Non-Institutionalized (1 out of 59), and Institutionalized (0 out of 50). For the ear showing the greatest Hearing Loss in Table 2, the proportions were: Control (2 out of 77), Non-Institutionalized Mentally Retarded (3 out of 59), and Institutionalized Mentally Retarded (3 out of 50).

Accepting a criterion which is widely used in audiology to define significant Hearing Loss, (two frequencies, 20 db), the proportions among the three groups are again similar. For the ear showing the least amount of Hearing Loss, Table 1, the proportions are the same as with the last criterion. For the ear showing the greatest Hearing Loss, Table 2, the proportions were: Control (2 out of 77), Non-Institutionalized Mentally Retarded (1 out of 59), and Institutionalized Mentally Retarded (0 out of 50). It may be of interest to note that the modal point for the three groups is the same (two frequencies, 0 db Hearing Loss). There are greater proportions of the control group at the more stringent criteria than for the two mentally retarded groups. Above the modal point for both ears (two frequencies, 0 db Hearing Loss), there are greater concentrations of the two mentally retarded groups than for the control group. However, these estimates of Hearing Loss

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do not reach levels considered to be significant.

In Tables 3A, 3B, 4A, and 4B the number of subjects from each group that exhibited Hearing Loss at the various criteria levels is given. Each criterion includes the number of Ss whose Hearing Loss reached the level stated but did not reach the next higher level. Only the data from S's ear that showed the greatest loss was considered. It will be recalled that an attempt was made to have every S tested by the four test procedures, hence the results for most Ss will appear under each of the four tests. The Ss who were not tested by a given procedure were not included in that test result.

The data presented in Table 3A were cast in a form designed to facilitate comparisons among the three groups of Ss. In Table 3B a cumulative percentage of persons within each group that reached the indicated criteria is shown. The tables begin with the highest level of Hearing loss (two frequencies, 30 db).

Table 4A, on the other hand, was designed to facilitate inspection of differences among hearing tests. In Table 4B the same percentages as 3B but in a non-cumulative fashion are presented.

The differences among the tests are shown in the tables. For instance, in the control group at the criterion of two frequencies with 30 db loss, no child had this much loss in the Standard or Eye-Puff tests; only one child had this much loss in the Four-Choice, but fifteen children had this much loss in the worse ear for the Békésy test. The same sort of ratio is true in the non-institutionalized MRs and the institutionalized MRs. Following the rationale of this part of the study, the Békésy is a relatively insensitive measure of hearing for all of the children in this study.

TABLE 2A

NUMBER OF SUBJECTS IN EACH GROUP THAT SATISFIED EACH ONE CATEGORY
IN THE POWER LAW OF THE DISPERSED MEASUREMENT AS MEASURED BY THE STANDARD ERROR

Test	Standard			Type-Buff			Type-Quiesce			Subject		
	Central	Test 11.	Test 12.	Central	Test 11.	Test 12.	Central	Test 11.	Test 12.	Central	Test 11.	Test 12.
2 frequencies 20 db	0	3	0	0	3	0	1	1	3	10	11	11
1 "	1	1	1	2	0	0	0	0	0	10	7	7
2 "	1	1	0	1	0	0	1	0	7	11	6	6
1 "	2	3	7	1	0	0	1	1	4	11	1	1
2 "	5	10	13	4	13	6	3	11	10	11	1	1
1 "	10	10	13	3	11	3	10	10	4	6	0	0
2 "	45	22	16	37	23	4	43	23	6	0	0	0
1 "	5	1	2	9	2	3	10	0	0	1	0	0
2 "	6	0	0	10	1	0	6	2	0	0	0	0
1 "	2	0	0	3	0	0	2	0	0	0	0	0
Total	77	59	60	76	113	20	77	54	62	76	50	50

TABLE 29

COMPARATIVE PERFORMANCE OF 2" x 2" 20
 EACH GROUP WITH HEARING LOSS AS GREAT AS OBSERVED FOR SAME TEST THAN THE OBSERVED OBSERVED IN THE NORMAL EAR

Test	Standard		Eye-Puff		Foot-Clasico		Sitting	
	Control	Mean	Control	Mean	Control	Mean	Control	Mean
Criteria of Hearing Loss	Control	Test (H.)	Control	Test (H.)	Control	Test (H.)	Control	Test (H.)
2 frequencies 30 db	0.0	3.1	0.0	3.7	1.2	1.0	23.6	60.0
1 " 30 db	1.3	6.8	2.7	3.7	1.3	1.0	29.2	71.0
2 " 20 db	2.6	8.5	4.1	3.7	2.6	1.0	34.1	86.0
1 " 20 db	5.2	13.6	3.5	3.7	3.0	1.0	31.0	94.0
2 " 10 db	11.7	44.1	10.0	34.0	10.6	1.0	36.1	100.0
1 " 10 db	24.7	61.0	17.7	36.7	23.6	1.0	43.7	100.0
2 " 0 db	83.1	98.3	67.7	94.3	79.2	1.0	94.6	100.0
1 " 0 db	89.6	100.0	79.6	94.1	92.2	1.0	100.0	100.0
2 " -10 db	97.4	100.0	93.3	100.0	97.6	1.0	100.0	100.0
1 " -10 db	100.0	100.0	100.0	100.0	100.0	1.0	100.0	100.0

TABLE 4A

PERCENT OF SO FOR EACH TEST GROUPS MEANS, LISTS TO THE RIGHT
 FOR THE TWO GROUPS MEANS, LISTS TO THE RIGHT

Group	Control				New Test (1st) Control				New Test (2nd) Control			
	Standard	New Test (1st) Control	Post-Test	Post-Test	Standard	New Test (1st) Control	Post-Test	Post-Test	Standard	New Test (2nd) Control	Post-Test	Post-Test
Criteria of Meaning Loss												
2 frequencies 20 db	0	0	1	16	3	3	3	1	0	0	2	15
1	1	2	0	13	1	1	0	0	1	0	0	7
2	1	1	1	11	1	0	0	0	0	0	7	6
1	2	1	1	12	3	0	0	1	7	0	6	6
2	3	4	2	13	15	13	13	13	13	6	10	7
1	10	5	10	6	10	11	16	16	13	5	6	0
2	10	5	10	6	10	11	16	16	13	5	6	0
1	4.5	3.7	4.3	0	22	21	23	23	16	6	0	0
2	5	9	10	1	1	2	0	0	1	3	0	0
1	6	10	4	0	0	1	2	0	0	0	0	0
2	2	5	2	0	0	0	0	0	0	0	0	0
1	3.7	7.6	7.7	7.6	10	13	16	16	60	20	62	50
Total												

論議は、このように進められていく。

[illegible]

The other three cases were somewhat similar in their consistency for children. An interesting sidelight on the tables are the results associated with the hearing loss at two frequencies at 3 db hearing loss. The greatest number of children (boxed values) were registered for this category in each of the Standard, Eye-Puff, and Four-Choice cases. This was true for the controls as well as for the MIs.

All the criteria thus far have been concerned with categorizing and stating hearing loss present in terms of intensity by frequency for the total number of frequencies tested. It is also of interest to consider tests for significant hearing loss which relate to Speech Reception Thresholds. The pure tone frequencies that bear relevance to Speech Reception Thresholds are 500, 1,000, and 2,000 cps. There exist four methods of deriving estimates of the significance of hearing loss for speech. These methods are similar to each other and all consider the pure tone frequencies noted above. Due to the lack of definitive information regarding the validity of these measures, the raw data will be categorized by each method. Method A considers the mean threshold which is derived from the thresholds for frequencies 500, 1,000, and 2,000 cps. If this mean is 20 db or greater, the person is said to have a significant hearing loss for speech. Method B is similar with the exception that the mean threshold is 30 db or greater. Data for these two procedures are presented in Table 3. The data is categorized by groups: Control, Non-Institutionalized MIs, and Institutionalized MIs and also by tests. The percentage of Is from each group that possessed at least (a) 20 db, or (b) 30 db, hearing loss for the mean of frequencies 500, 1,000, and 2,000 cps is shown in the table.

With the exception of the Sidney test, less than two and a half

TABLE 3

PERCENTAGES OF DISPERSED SEEDS AVAILABLE TO THE BIRD
 1961, 1962 and 1963 open land at 1100 ft
 (a) 10 db (b) 15 db (c) 20 db (d) 25 db (e) 30 db (f) 35 db

Type	Group					
	Control		Non-Dispersed, 100%		Dispersed, 100%	
	(a)	(b)	(c)	(d)	(e)	(f)
	10 db	15 db	20 db	25 db	30 db	35 db
Standard	0.0	0.0	1.7	0.0	0.0	0.0
Open-Field	0.0	0.0	1.9	0.0	0.0	0.0
Open-Grass	0.0	0.0	1.9	1.9	2.6	0.0
Grass	10.7	1.3	22.4	0.2	13.0	0.0

percent in any of the three groups have significant hearing loss for speech. In the same table, the Wilcoxon test data indicate that 33.3 percent of the control group have significant hearing loss for speech, the non-institutionalized MIs have 22.4 percent hearing loss for speech and institutionalized MIs have 17.3 percent hearing loss for speech. These figures are relevant to the differences among tests and not to differences among groups. A single estimate would be that all of the groups have a similar chance of significant hearing loss for speech.

Method 1 for determining significance of hearing loss for speech considers the two frequencies out of 100, 1,000, and 2,000 cps, in which there is the least amount of hearing loss. The sum of these two frequencies must reach 33.3 for the person to be said to have a significant hearing loss for speech. Method 2 is similar with the exception that the sum of the two best frequencies must reach 33.3 for the person to be designated as having a significant hearing loss for speech. The data by groups and tests are shown in Table 6. These percentages of subjects reaching the indicated criteria are classified according to test. Inspection of the table indicates similar conclusions as with the previous table concerned with speech reception. That is, there is no justification for stating that MI children have a greater incidence for hearing loss for speech than non-MI children.

A factor to consider when comparatively evaluating tests for hearing loss is the extent to which Ss from a given group are unevaluable by a selected test or method. The structure of the test may be such that it is difficult to shape the responses of a S to the appropriate stimuli. It may also be that once the test had been administered it would be

TABLE 4

PERCENTAGES OF SUBJECTS WHICH REACHED LONG FOR THE SHORT
 TWO SET OF THREE PRISMS (700, 1,000 and 2,000 cps)
 REACHED AT LEAST (a) 20 db OR (b) 30 db FOR THE BETTER EAR

Test	Control		Non-Test 12, 18a		Test 12, 18a	
	(a)	(b)	(a)	(b)	(a)	(b)
	20 db	30 db	20 db	30 db	20 db	30 db
Standard	0.0	0.0	1.7	0.0	0.0	0.0
Eye-Puff	0.0	0.0	1.9	0.0	0.0	0.0
Four-Choice	0.0	0.0	1.9	1.9	2.6	0.0
Wiley	6.7	0.0	12.2	2.0	3.3	0.0

TABLE 7

NUMBER OF SUBJECTS WHO WERE NOT TESTED IN EACH GROUP AND BY EACH TEST.

Test	Group					
	Control		Non-Tested. MIA		Tested. MIA	
	1*	2*	1	2	1	2
Standard	0	0	0	0	2	0
Eye-Puff	2	1	0	0	9	22
Post-Office	0	0	4	1	0	1
Reading	2	1	0	1	4	10
Total #	77		10		31	

*1. 2c on which test was attempted but appropriate response was not obtained.

*2. 2c on which test was not attempted for reasons of availability or scheduling.

difficult to score because of disparity among response groups. Data in Table 7 represent the number of Ss from each group by test on which tests were not obtained. The table is sub-divided into two categories:

(a) where tests were attempted but results could not be reported because of being unable to structure the Ss responses to the task or not being able to reasonably assign numerical values to the responses that were obtained; (b) where Ss were not tested because of scheduling or non-availability of the S for the full battery of tests.

The standard test was most effective in terms of being able to test most of the Ss from the three groups. All of the Ss from the control group and Non-Institutionalized MR group were testable by this procedure. Only two Ss from the Institutionalized MR group were not testable by this test. The Eye-Puff test was not usable on two Ss from the control group, six Ss from the Non-Institutionalized MR groups and seven Ss from the Institutionalized group. The Four-Choice test was usable on all of the control group, all but four from the Non-Institutionalized MR group, and all but eight Ss from the Institutionalized MR group. It may be of interest to note that of the twelve Ss not testable by the Four-Choice test, eleven had IQs below 60, the twelfth S had an IQ of 64, indicating the possibility of a cutoff point of applicability of the Four-Choice test with respect to IQ. The Minkay test was unusable for two Ss from the control group, eight Ss from the Non-Institutionalized MR group, and four from the Institutionalized MR group. The three tests other than the standard test all appear to have a higher rejection rate for the MR groups than for the control group. The Four-Choice test was the only test that showed an appreciable relationship of IQ with inability to test Ss. If one had to select one test from this data it

would appear that the Standard test would be most applicable.

Another method of assaying the relation between IQ and Hearing Loss is through correlation procedures. If Hearing Loss increases as IQ decreases, correlation should indicate the significance of this relation. Accordingly, Pearson's r was used correlating IQ as measured by the Wechsler-Bellevue Intelligence Scale for Children with a single value threshold for each test. The threshold for each subject by test was derived by summing the db of Hearing Loss at the several frequencies used in each test. The correlations obtained from these analyses are shown in Table 8. Also shown are the mean thresholds for each test grouped by IQ interval. These intervals are: 59 and below, 60 to 74, 75 to 89, 90 to 104, 105 to 119, and 120 and over.

Significant negative correlations, at the .01 level of confidence, were obtained between IQ and each of the four tests. The correlations obtained were as follows: r IQ, Standard Test $-.36$; r IQ, Eye-Puff test $-.35$; r IQ, Four-Choice test $-.37$; and IQ, Békésy test $-.26$. These correlations would indicate a tendency for hearing thresholds to exhibit less Hearing Loss as IQ increases. The means for each test group by IQ interval suggest the order of this effect is less than 10 db for any test or for the whole group.

Figure 1 is an illustration to show the means for each test plotted by IQ interval. In addition to the slight tendency for Hearing Loss to decrease as IQ increases, the relative sensitivity of the four tests can be seen. It would appear in terms of sensitivity that the Standard, Eye-Puff, and Four-Choice Test have approximately equal sensitivity and the Békésy is about 15 db less sensitive.

While in general the relation between Hearing Loss and IQ ap-

TABLE 8

THE RELATIONSHIP BETWEEN IQ AND AVERAGE
THRESHOLD FOR FOUR HEARING TESTS

Tests	r with IQ	59 and below	60-74	75-89	90-104	105-109	120 and above
Standard	-.36	3.65	2.84	1.26	-0.09	-2.76	-1.55
Eye-Puff	-.35	2.59	0.89	0.00	-0.94	-3.87	-2.89
Four-Choice	-.37	5.60	2.77	1.61	0.29	-2.38	-3.53
Békésy	-.26	18.22	14.10	13.89	12.44	9.50	11.03

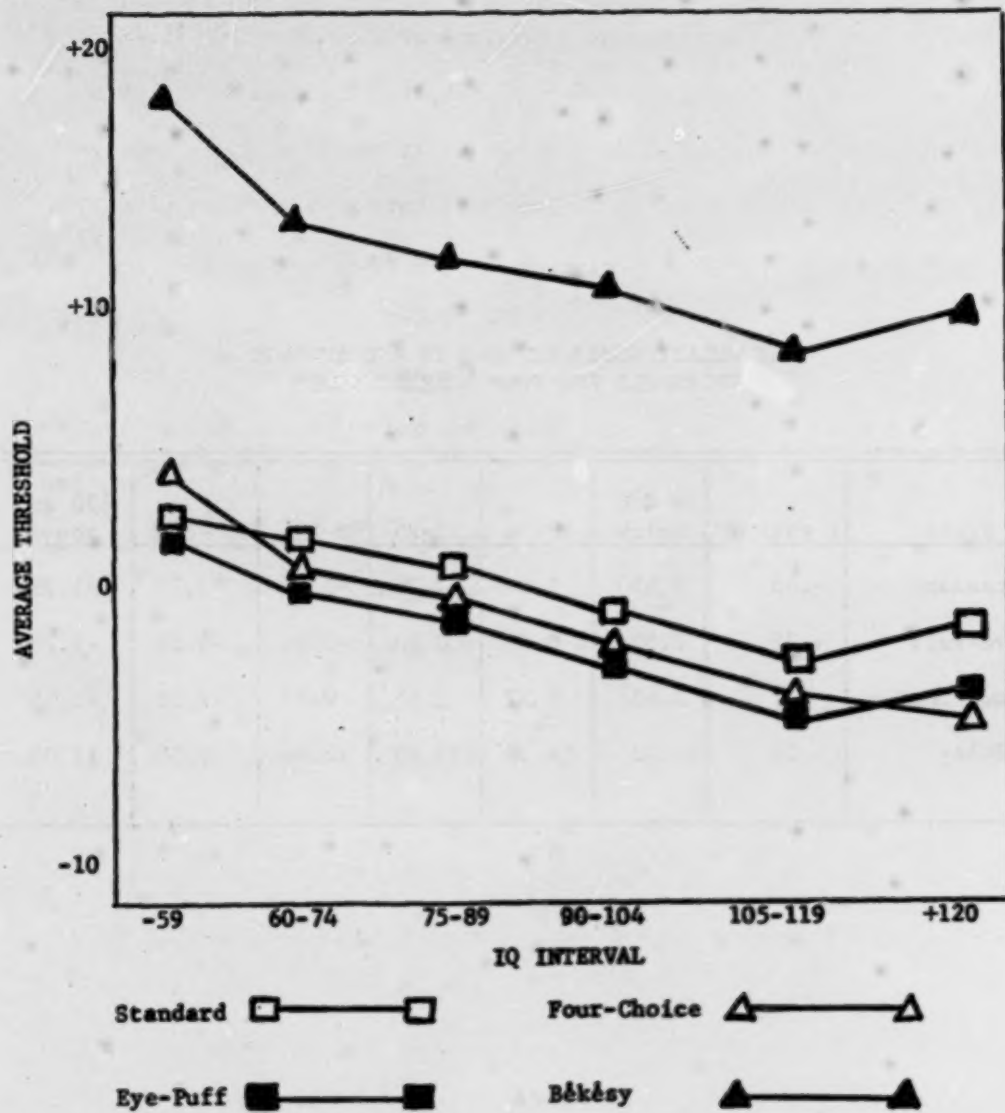


Fig. 1. Mean values of Hearing Loss shown as a function of the kind of test and of Intelligence Quotient.

pears to be a smooth function, there is some slight evidence that both the Békésy test and the Four-Choice test tend to deviate from a straight line fit for the lowest IQ group. The relation for the lowest IQ group (59 and below) may indicate that the slope of the function between IQ and average threshold may be somewhat steeper. The reason for this deviation is not apparent from this data. It may be significant that both of these tests required some level of motor skill. The procedure for the Four-Choice test involves presenting four defined temporal intervals with S required to select which of the intervals contained a tone. This involves what may be labeled a memory process inasmuch as S could not respond till the last interval had been presented. Perhaps this procedure taxed the capacity of the lower segment of the MR groups. A follow-up study is planned with a modified Force-Choice procedure in which the alternatives are graduated from two to sixteen.

The data offered would indicate no difference among the mentally retarded and normal children tested in terms of Hearing Loss to the extent that it would impair educational or social processes. This finding is in definite contrast to previous studies designed to assess the hearing potential of mentally retarded children. The previous investigations reported that from 15-50% of the mentally retarded population possessed significant Hearing Loss. This investigation found the incidence of Hearing Loss among the mentally retarded children did not differ from that of a normal group and further it seemed the incidence of Hearing Loss among all the groups to be comparable to the incidence of Hearing Loss for the population as a whole (1-2%).

The explanation of the discrepancy between this study's findings and the findings reported by other investigators may lie in several

areas, such as testing methodology, motivational procedures, or sample differences. What may be most likely is that groups of mentally retarded children tested by this study were not comparable in IQ to the majority of such Ss used in the previous studies.

All significant Hearing Losses are based of course on the criteria for significance. The audiologist is free to define significance in any logical way that he may choose. No particular stand was taken for the present study, rather an eclectic comparison of the results of tests was made with the most common criteria. Inspection of the major tables 3A, 3B, 4A and 4E demonstrate the obvious point that the proportions of the groups showing significant Hearing Loss vary in a direct manner with the stringency of the criteria. This is such an obvious point that it seems trivial to discuss. However, this is a point which should be discussed more in print.

The low but significant correlation reported in Table 8 deserves some comment. The large number of observations that contributed to each correlation allowed even a slight association (see Figure 1) to be significant. The data on this study does not point to a high degree of relation of Hearing Loss and IQ.

Appendix A

A note on differences between two methods employed to instate the eye-blink response in the presence of a tone.

The rationale for the first method was based on respondent conditioning, that is, an "unconditioned stimulus" (air puff) was paired with a "conditioned stimulus" (tone) in 50 per cent of the tone presentations. In accord with the principles of a respondent conditioning, the "Conditioned stimulus" (tone) should acquire the power to elicit the eye-blink response in the absence of the air puff. Further, after conditioning has occurred, it is necessary to make a large percentage of pairings of the air puff with the tone preventing disintegration of the stimulus-response bond. If steps have been taken to facilitate generalization along the intensity and the frequency axes, threshold measures may be using this procedure.

Previous investigations using air-puff as an unconditioned stimulus have been directed at variables such as latency between conditioned stimulus and unconditioned stimulus, pairing schedules, intervals between pairings, and the generalization problem, reported methods yielding good results. They found the test satisfactory for normal and hard-of-hearing adults.

With the MRs the test was impractical because: (1) the time required to condition to a criteria of three successive responses in the absence of air puff was excessive; (2) some subjects responded to the air puff by crying and others by keeping their eye lids closed continuously

or blinked rapidly all the time; and (3) once the above criteria had been met, despite frequent pairings of air puff with tone, the conditioned stimulus-response bond was hard to keep from disintegration. These reasons lead to a new method of forming, preserving, and identifying the tone eye-blink connection.

The new method was based on operant conditioning wherein the concept of reinforcement (avoidance conditioning in this case) was added. Following this methodology, the tone was looked on as a discriminative stimulus which may occasion a response (eye-blink) to avoid the air puff on the eye. The specific procedure for the operant eye-blink conditioning was as follows. A loud tone, usually 1,000 cps, was given in one ear. Approximately one-half second later, while the tone was still on, a rather severe puff of air was delivered to the eye. This severe puff of air generally elicited a semi-startle response. The tone was turned off immediately after the puff. The subject was informed that he could keep the puff from recurring with the tone if he would use an exaggerated blink. He was then given a loud tone and if he did not perform the exaggerated blink, it was demonstrated to him by the experimenter. If another presentation of tone did not occasion the exaggerated blink, another rather severe puff of air was delivered to his eye. Verbal instructions and tone-puff combinations were continued until the desired response was present in the absence of the air puff. The S was urged to look at a line drawing on the wall at a level slightly above eye level. The temporal intervals were such that the subject had "warning" time to respond before the air puff. Further, if the response was occasioned by the tone, the air puff was not administered. The first eye-blink to the tone along was attended by the experimenter giving the subject a penny

or chewing gum, and he was also given verbal approval and the promise of more such rewards if he continued to do well. Following this procedure, all but a few subjects conditioned rapidly, and it was seldom necessary to reinforce with an air puff once the test procedure had been instigated.

Because of the efficiency with which the operant procedure occasioned and sustained the desired response, it was substituted early in the testing program for the procedure based on respondent procedures. An advantage of operant over respondent procedures was in the nature of the response obtained. With the respondent procedures it was at times difficult to distinguish the character of the conditioned blink from the type associated with random eye-blinks. With the operant procedures, the response was a blink plus a full grimace which was observably different from the random blinks noted above. A more cogent advantage was the fact that once begun, testing proceeded very quickly, and thresholds appeared to be at least as reliable as the standard test.

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SECTION III

**VISUAL SIGNAL DETECTION, PERCEPTION, AND RESPONSE VARIABLES AS
FUNCTIONS OF DEVELOPMENT AND MENTAL RETARDATION**

By

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ABSTRACT

A series of psychophysical tasks, perceptual tasks, and other response tasks were run in an experimental analysis of perceptual responses of mentally retarded and normal children of various ages.

The major results obtained were the following:

1. Voltage required for signal detection (forced-location) was independent of I.Q., but varied inversely with age.
2. Reaction time was an inverse function of both age and I.Q.
3. Children with lower I.Q.'s gave consistently more overestimative responses in signal detection (Yes-No), used more definite responses, gave more false alarms, reported more signal detection at intensities too low for accurate location, than did normal children, for whom such responses tended to diminish with age. Retarded children also overestimated in size constancy tasks.
4. Retarded children also took more time to complete tasks, and there was considerable response attenuation in the absence of training and prompts.
5. Curves and data considered developmental were replicated using certain combinations of procedures, but other results were at times obtained when other procedures, in some cases involving more valid conditions, were utilized.
6. Proportions of color blindness found in normal and retarded populations were identical with general population proportions.

Implications for perceptual research were discussed. It was sug-

gested that between psychophysical procedures, in which the stimulus is easily specified, but the administration seems complicated, and other perceptual procedures, in which the administration is simple, but the stimulus is difficult to specify, the psychophysical procedures are more amenable to experimental analysis, and may provide considerable data in the areas of development and retardation. A methodology was suggested and applied in an attempt to specify the variables operating in the various perceptual curves obtained.

In the area of retardation and development, application of these procedures suggested that it may be an open question as to whether perceptual differences now considered developmental or functions of retardation may be related to differences in nonperceptual variables, rather than to differences in perception.

Implications for educational practice and research were discussed. It was suggested that the overestimative behaviors found in the retarded might be related to variables associated with the segregation of retarded from normal children. Such segregation was related to educational necessities of not retarding normal children, and teaching retardates at their own pace. Alternative procedures were considered. Specifically, it was suggested that whereas aversive consequences applied to overestimative behaviors of normal children tended to attenuate such responses as a function of prolonged exposure to such socialization, acceptance of such behaviors of retardates by teachers in special classes may continue them at the high levels noted. Regarding the problem of perceptual response attenuation in retardates, which makes perceptual experimentation difficult with these subjects, it was suggested that this might be resolved through research in the application of procedures currently developed in

laboratory control of behavior of individual organisms.

It was concluded that further laboratory research may provide specification and control of the variables operating in perceptual responses.

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CHAPTER I

THE PERCEPTUAL PROBLEM AND MENTAL RETARDATION

The experimental literature on perception in mentally retarded children is characterized, if anything, by its paucity. Classical texts such as those by Sarason (1953) and Tredgold (1956) have very few references to the subject; indeed an index reference in Tredgold to "defect of perception" turns out to be a reference to a child who allegedly amputated the head of another child in order to surprise him in the morning when he woke up with no head; this is considered defective perception of the real nature of the crime committed.

Naturally, a definition of perception must be considered before any statements are made about it. This discussion will exclude from consideration all definitions of perception of the kind just presented, since such a definition of perception equates it with comprehension of some kind and is akin to the use of the statement "I see" made by a blind man to whom something has just been explained. Zuk (1958) in a discussion on perceptual processes in mental retardation, defines perception in terms of the attribution of meaning to sensory stimuli. Such a definition renders experimentation in mental retardation difficult, since if the attribution of "meaning" by a mentally retarded child is somehow deficient when compared to a normal child, one is not certain whether the defectiveness in meaning is to be attributed to not understanding the meaning of the stimuli, the meaning of the instructions

given by the experimenter, the meaning of the task before the subject, or remembering from one presentation to the next what should be done.

Omitting subjective terms such as meaning and substituting behavioral statements for them makes it no easier to locate the focus of difficulty, since each perception experiment is an extremely complicated experiment. On the face of it nothing seems easier or more in accord with common sense than to present a subject with a visual (auditory, tactual, etc.) stimulus and to ask him what he has seen (heard, felt, etc.). The subject's statement can then be related to stimulus variables, and data thus obtained can be evaluated in terms of parameters such as retardation, mental age, reward, and the like (cf. Keller and Schoenfeld, 1950). When, however, the attempt is made to assay the perception of organisms which do not speak, such as animals, the apparent ease of inferring perception from the perceptual situation vanishes. This statement can be extended to perceptual experiments with mentally retarded children, or children who have linguistic difficulties. Experiments with such populations focus our attention on the methods whereby the results are obtained, and these become the crucial variables in an experiment. And, needless to say, such methodological considerations must also hold where the subject is verbal. Any experiment in perception involves, for example, a training period. In behavioral terminology, training in discrimination must first be established. For example, differential consequences ensue upon responses made in the presence of a light or in its absence. If a given response in the presence of a light is rewarded and the same response in the absence of a light is not rewarded, after a while the animal may respond when the light goes on and may not respond when the light goes off. In this case, the response now

discriminates between absence and presence of light. After such training, the light may be varied in intensity, and the relationship of the response to the intensity of the light may now be used to assay discrimination. The intensity at which the light occasions a response 50% of the time was considered in classical psychophysics as the threshold. Although the example chosen is from classical psychophysics, its methodology is the paradigm for most experiments in perception: there is initially a training period with differential consequences attached to the response, after which the tests are run. In the case of many perception experiments with human subjects, the training period may consist merely of verbal instructions. Although these verbal instructions may be presented in a very short time, they telescope into that short time the lengthy training procedures used with animals. All the variables found in the training of animals will be present in this situation, although this may not be immediately apparent. An example is the case of the consequences of the response, or the reward in the training period. If food is used as a consequence, that is, the animal gets fed each time he delivers the response the experimenter desires, the effectiveness of the food will be related to the amount of food deprivation undergone by the animal. An animal who has just been fed may not make such differential responses. Thus, motivational variables will affect the discriminatory response and therefore the consequent curve obtained. In the case of the human subject, such variables are subsumed under attempt to "attain rapport" with the subject in order to "establish the right set", that is, to get the subject to work as desired by the experimenter. The subject not performing may be considered "negative", "unmotivated", and so on. Accordingly, it becomes extremely difficult in

a perception experiment, where the occurrence of a discriminatory response is less frequent than that expected by the experimenter, to assign this depression to "inferior" discrimination, motivation, reinforcement, training, and the like. These statements hold for normal subjects; they apply at least as well to the mentally retarded.

In this regard, Barnett and Cantor (1957) in an experiment on discrimination set in defectives, reported that mentally retarded subjects who previously had not given differential responses to a triangle when placed upside down or rightside up, were able to give such responses after a training period involving discriminatory responses to semi-circles on white or black backgrounds. One might have concluded from the initial experiment that the mentally retarded subjects could not tell the two triangles apart from each other; on the other hand, data from the second experiment make it more consistent with the data in discrimination learning to state simply that a discriminatory response was established by the training procedures in the second case, but not in the first. House and Zeaman (1958) report that imbeciles are inferior to Harlow's monkeys in similar visual discrimination learning tasks.

Knoblauch (1934) presented pairs of figures to normal and mentally retarded subjects. One of each pair of figures was always a solid black circle, and responses occasioned by the circle were consistently reinforced. After such a training period, he presented other pairs of figures which did not include the solid black circles. Responses of the mentally retarded children generalized toward the solid black figure in each pair regardless of shape, whereas, responses of the normal subjects tended to generalize toward figures with round outlines. These

differences are interpreted in terms of perception of similarity. The experiment may, however, reflect differences in prior training. Had the mentally retarded been reinforced for making the same responses in the generalization session as the normals, the results may have been otherwise. Other experiments in perception by the mentally retarded include research in reversal of Lissajou figures by McMurray (1954), in apparent motion by Werner (1950), in figure-ground relations by Werner and Strauss (1941), and critical flicker fusion frequency by Werner and Thuma (1942). Each of these involve highly complex situations in which variations in the response are attributed to differences in perception. Spitz (1959) reports fewer figural after-effects reported by retarded children than by normals, and concludes that "mental retardates demonstrate a strong resistance to cortical change." This inference of physiological difference, as well as a perceptual difference, comes solely from differences obtained in the various responses, which are subject to control by training variables, motivational variables, and the others cited. Other studies and discussions relate reading and similar training to perception (e.g., Dunn, 1954; Gregg, 1956; Jolles, 1958.)

In the area of color blindness, O'Connor (1957) and Kratter (1957) report a greater incidence of color blindness in extreme cases in mental retardation (imbeciles) than in either normals or the garden variety of feeble-minded subjects, who presumably display no differences. Remoli (1933) reports that feeble-minded subjects tend to have difficulties in naming of colors but not in other certain discriminatory responses involving color. Kirschen (1954) reports a higher incidence of strabismus in mentally retarded children.

The extent to which mental retardation is related to brain damage is, of course, germane to the perceptual problem being discussed, and is an open question. Since the studies to be reported can shed no light on this problem other than to discuss the methodology of perception, which may be appropriate, the issue of possible brain damage will not be discussed; many visual anomalies are, of course, related to brain damage, with examination of the retina of the eye as a window to the central nervous system being almost standard procedure.

No statements made in this discussion should be interpreted to mean that the perception of mentally retarded subjects may not be different from that of normal subjects. Undoubtedly, mentally retarded subjects will be found who will give responses in the presence of discriminatory stimuli which are different from those given by normals. The point being made is very simply that since a variety of variables other than perceptual variables can account for such differences, before these differences are assigned to perceptual variables, the argument must be developed that the other variables which may have entered have not done so. Hence, the stress on methodology.

Another source of data bearing on the problem of perception and mental retardation refers to the development of perceptual responses as a function of age. Chronological age enters into the equation for the IQ score, and it is on the basis of tests based on tests generally related to IQ tests that children are classified as mentally retarded. Accordingly, if discrimination develops with age, there is a possibility that some children, at least, may not have developed to the level of their peers, a point stressed by Zuk (1958), who emphasizes the importance of developmental data in the study of perception in the mentally retarded.

This position will be considered in greater detail in the discussion of the experiments which form the basis of this study.

Indeed many intelligence tests and related tests utilize figures and drawings involving hidden or impeded figures, visual illusions such as the Muller-Lyer, tests of closure, and the like, which are considered perceptual. The clinical literature in this area as it relates to mental retardation will not be reviewed here since ample reference to it can be found in any standard text involving these clinical procedures. These tests involve stimulus figures which are extremely complex and extremely difficult to specify. They are also often characterized by definitions of perception which are equally complex and difficult to specify. For example, the Rorschach test is often regarded as a perceptual test. A subject who gives the F+ response of seeing a butterfly when Card I is presented may be considered as having different perception from the subject who gives the F- response of having seen a dinosaur. Different responses are being made, that is, discriminatory responses occur. But whether or not these relate to differences in perception or other variables of the nonperceptual kind discussed, is open to question. Whether or not perception of a butterfly (or a dinosaur, for that matter) is involved, or some verbal response governed by other discriminative stimuli, might be settled by presenting the subject with a pile of 20 cards containing 10 Rorschach plates and 10 plates of butterflies, and asking the subject to separate the pile into two stacks of 10 cards each. If the same subject who said: "I see a butterfly" now sorted butterflies into one pile and Rorschach plates into another, the perceptual inference from his report of seeing might be questioned. This outcome, of course, would not challenge the validity of the Rorschach

test as an indicator of psychosis (which validation must come on other grounds), but would challenge it as an indicator of perception (cf. Goldiamond, 1958^a). The Gestalt experiments on closure, the clinical perception literature, and the illusion experiments, all of which enter into developmental tests, may require careful analysis to ascertain the extent to which perceptual and other variables enter into the results obtained (cf. Goldiamond, 1958^b).

In the experiments which are the subject of this investigation, both types of stimulus presentations were utilized. On the one hand the study will report a series of psychophysical experiments using mentally retarded and normal subjects. A series of experiments was also run on these subjects utilizing certain of the figures more closely allied with more complicated interpretations of perception. The psychophysical experiments are characterized by the greater specifiability of the discriminative stimuli involved. To the author's knowledge, this is the first use of such procedures for mentally retarded children, per se. It is not general practice to utilize these procedures even for normal children and the study would have some bearing upon the extension of such psychophysical research using children as subjects. The rationale behind the use of the psychophysical tasks used is related to current developments in psychophysics which bid to alter conceptualization in the area of perception. These developments are related to work by Blackwell (1953) in forced choice and phenomenal report responses, to work in decision theory exemplified by Tanner and Swets (1954), and have been discussed in greater detail by the author elsewhere. The Gestalt perceptual tasks utilized were sampled from Thurstone's (1944) factorial study of perception. The rationale for the choice of tasks, in the context discussed, will be the basis of the discussion in the next section.

CHAPTER II

TASKS USED AND THEIR RATIONALE

In psychophysical threshold experiments, the stimulus is generally varied along some physical dimension (usually intensity or duration) with the subjects required to give differential responses in the presence or absence of the stimulus. The physical energy level at which "positive" responses (that is, the type conditioned in the presence of the light) occur 50% of the time has generally been considered the threshold, and there is a considerable body of literature on such research. The threshold has generally been considered a measure which tells something about the subject's sensitivity. Accordingly, it would seem logical to include such measures in a perceptual test of mentally retarded children.

Recent developments in psychophysical methodology have suggested that the concept of the sensory threshold leaves a great deal to be desired. Investigators have demonstrated that this allegedly sensory point is manipulable by variables considered extraneous to perception (cf. Goldiamond, 1958^b). Among these are consequences of the response, number of response categories, and scoring procedures used by the experimenter. The work of Tanner (1955) suggests that there is no make or break point at which information is received by the individual (which is the central notion behind the threshold) but rather, that information is continuous. If threshold curves can be manipulated by variables

extraneous to perception, the question of what such curves are measuring becomes an open one. Work in decision theory (cf. Tanner and Svets, 1954) suggests that while perceptual curves vary with stimulus intensity, they also vary with decision variables. In a Yes-No type of experiment, the subject can report Yes in the presence of the stimulus or Yes in its absence, the former being considered signal detection, and the latter being considered a false alarm. Signal detection has been found to vary as a function of the false alarm rate, that is, the more often the subject gives Yes responses in the absence of the stimulus, the more likely he is to report the stimulus when it is present. The less the subject gives false alarms, the less likely he is to report the signal when it is present. Signal detections and false alarm rate can be manipulated by explicit consequences of each type of response, making hazardous perceptual conclusions from the response.

Another type of response is the Forced-Choice response. Here a stimulus is presented in one of several locations or at one of several times and the subject is required to indicate where or when it was presented. The subject's accuracy is then checked, and accuracy as a function of stimulus discrimination would then seem to be a definition of sensitivity. Again, recent developments suggest that such responses can also be governed by their consequences, by their frequency, by the number of response alternatives available, and other variables extraneous to sensitivity (cf. Goldiamond, 1957).

What these statements imply is that the discriminatory response has no hallowed position in experimental psychology purely because it has a semantic referent to something seen or heard. It is like any other operant discriminatory response, and governed by the same variables

governing such responses, as discussed in the preceding section.

What differentiates a discrimination experiment from a learning experiment is usually that in the discrimination experiment the discriminative stimulus is being varied, and in the learning experiment the discriminative stimulus is usually at some high constant level. Nevertheless, all the variables of any learning experiment enter into any discrimination experiment. The differentiations between learning and discrimination exist for the convenience of the experimenter, but do not define the stimuli which control the subject's behavior. Accordingly, the only resolution of the problem is to specify precisely the methodology whereby the results were obtained, and attempt to control variables whose functional relationship with the response from the subject of study.

In the experiments to be recorded, two differing psychophysical indicators were used. For every signal presentation, the subject was required to give two different types of response. The signal was varied along two dimensions. It appeared (1) in different positions, and was simultaneously also (2) varied according to intensity. The subject was required to state both (1) whether or not he had seen the signal, the classical psychophysical response, and also was required (2) to locate the stimulus, whether or not he had reported seeing it. These two responses differ in that they have different histories of past stimulus control attached to them. What they have in common in this situation are variables connected with the stimulus, since the discriminative stimulus being varied is the same for each response. Accordingly, it was felt that the use of these two indicators for the same presentation might help differentiate perceptual from non-perceptual variables in the response. Since the two responses share in common the same discrim-

inative stimulus which occasions them their differences must be in terms of other variables.

Differences between these two types of response have been obtained in the past, and classically form the problem known as subliminal perception. In studies of this kind, the subject locates the signal accurately, but reports not having seen it. This has been regarded as "discrimination without awareness" (Miller, 1939), since the subject is presumably discriminating the stimulus without being aware of it. As the author has indicated elsewhere (Goldiamond, 1958^b), other interpretations are possible. In terms of the aims of this study, these interpretations could be conceptualized in at least three ways. What is being discussed is the presence of accurate locations, accompanied by the absence of report of having seen the stimulus.

(1) On an intuitive level, the subject may see a difference between one position and the other three, and name that position. However, he may not report having seen a difference for a variety of reasons. These may relate to his use of the terms, Yes-No. All language classifies experience, and the subject may be chary of classifying a dimly seen stimulus into the same category (Yes) as a brightly seen one, but would rather put into a more similar No category. Linguistic classification depends upon the audience, and the consequences it applies. I will speak French in France because speaking English may not have similar consequences. Similarly, use of language gets "refined" as one grows older, that is, the audience shapes our use of it. The consequences applied by the social audience are classically reward, punishment, or nothing. Accordingly, differences obtained between forced-choice and Yes-No curves as a function of age or IQ may reflect differ-

ences in types of audience control over children of different ages and IQ. Or, stated otherwise, in socialization.

(2) In terms of operant conditioning, the foregoing statements can be refined in terms of explicit controls by the audience over discriminatory responses, in the shaping manner indicated in the preceding section (Skinner, 1957). Different responses have differing histories of consequences applied by the verbal community, for example, use of certain four-letter words may be reinforced by the verbal community of the army, but not of the family. Differences between forced-choice and Yes-No responses might thus relate to differing histories of reinforcement, rather than to differences in discrimination since the discriminative stimuli being presented are the same.

(3) In terms of decision variables, the types of decisions required by the subject are different. In the case of forced-location, the subject merely responds in accord with which of the four positions differs along the dimension of the experiment (brightest, smallest for the two psychophysical tasks). In the case of the Yes-No response, since the energy distributions of the four positions are constantly varying around some point set by the experimenter, occasionally one of the noise positions (the position in which there is no signal) may be greater (in energy) than the signal-plus-noise position (the stimulus to be discriminated, in the more conventional terminology). Accordingly, the subject's responses set some criterion above which Yes is reported, and below which, No is reported. This criterion can be shifted in accord with consequences applied to such responses. For example, fining the subject heavily for giving false alarms, and compensating only slightly for signal detections, will shift the response curve away from signal

detection, and produce "high thresholds", while forced-location accuracy may not be similarly affected since different decision functions are involved. Accordingly, differences between these curves may reflect differences in decision functions as a function of age and IQ, in terms of past histories of consequences of relevant behaviors, and the variables of the experiment.

All three approaches have in common differential consequences attached to the response involved. The intuitive approach has as a major difficulty the invocation of processes which can not be observed by the experimenter. The use of experimental terms as explanation for the responses involved may contribute little that can not be explained in terms of functional relations between the responses themselves (which, in all events, are the data that are being manipulated) and the stimuli introduced. Conceptualization in terms of operant conditioning involves explicit statement of controlling variables, and accordingly lends itself to ready experimental analysis and control. The same statements apply to decision theory, and it should be stressed that the term decision, as used here, does not refer to an intuitive process, but rather to a set of mathematical relations subsumed under the term decision theory. The two latter approaches, both emphasizing functional relations between observables, naturally differ in certain aspects which are beyond the scope of this discussion. Nevertheless, they provide a rationale for the use of these two sets of responses, and for interpretation of differences found between them which may be related to the developmental and IQ problems of this study.

Such paired psychophysical responses were obtained from subjects in two types of discrimination. One involved size discrimination, and

the other an absolute discrimination. In the size discrimination task, four circles appeared up, down, left, and right. One of the circles was smaller than the other three, which were of the same size. The subject had to indicate where the smaller one was and whether or not he had seen it. The second task involved location of a circle which could appear up, down, left, or right. The subject had to indicate where it was and whether or not he had seen it. This task differs from the size discrimination task in that in the size discrimination task four circles are always present and a ready reference point is available. In the absolute discrimination task, such a ready reference point is not available. These were standard psychophysical experiments using a constant randomized method with the stimulus presented for each subject about 200 times in a manner to be described later.

In addition to these tasks, the subject was required to respond in other perceptual situations. A size constancy task was utilized. In this task, a triangle at some distance from the subject was made smaller or larger. The subject had to match its size with a triangle very close to him. Another task involved the Muller-Lyer Illusion. The subject was required to give responses of equality and size from cards on which the illusion was presented. A similar procedure was also utilized for the Titchener Circles Illusion. Differing orders of presentation were used: ascending, descending, and randomized. In addition, differing responses were utilized; equality, left larger than right, and the like. As in the psychophysical situations, similar stimulus presentations were presented for differing responses, with the rationale that differences in responses might reflect differences in past control over such responses, rather than perceptual differences, with the hope that such could be re-

lated to the developmental and IQ variables of the study.

The nonpsychophysical tests were selected from Thurstone's (1944) battery in terms of perceptual factors assigned to them. Since one of these factors is called "perceptual speed", a test of reaction time was also chosen. Subjects were required to shut off either a buzzer, a white, or a red light, when these went on. Under certain conditions at certain times any one of these could go on, and at other times only a specified one would go on.

Standard color-vision tests were also utilized.

As can be gathered from the types of tests used, a variety of perceptual tasks was studied. These ranged from psychophysical tasks to illusions to size-constancy. The procedures common to all involved the occasioning of more than one response to similar stimulus presentations. The rationale common to these procedures involved the analysis of differences between such families of responses occasioned by similar presentations. This analysis was then to be related to differences in age and intelligence quotient, in terms of differential (or absence of such) control by discriminative stimuli, by decision variables and consequences from the verbal community, and other such variables.

CHAPTER III

PROCEDURES

In the experiments to be reported, two different perception laboratories were used, one on campus, and the other a mobile unit constructed for the purposes of this study. The mobile unit, converted from an Army trailer, was moved to the Lincoln State School, and was utilized to test children there. Children from regular schools, and from classes for the educable mentally handicapped were brought to the campus laboratory for testing. Differences between the laboratories will be discussed in the course of the report.

Psychophysical Tasks.

A. Booth Used: Campus. The booth used on campus was shaped like a three-jointed telescope. The subject sat at the narrow end, and the screen was at the broad end ten feet away from him. Lights were concealed in the joints of the telescope in such a manner that they illuminated the walls and the screen but cast no direct light into the subject's eyes. The booth was light-controlled with the interior surface the rough side of masonite painted neutral gray. The back wall of the booth was three feet wide, the second partition four feet wide, and the front wall (the widest section of the telescope) was five feet wide. In the center of the front wall at the subject's eye level was a three feet by three feet white screen, uniformly illuminated. Projection was from the rear by means of a projector outside the booth

which projected over the subject through an apperture in the back wall.

1. Lighting. Current for booth and projector lights was controlled by means of a constant voltage regulator and variable resistors. For the lights in the booth, the variac was set at 60 volts. For the projector, manipulation of the variac was one of the experimental variables. Current flow and voltage were constantly metered by two ammeters and voltmeters, one pair for each circuit.

2. Timing Controls, Sequences. Control of stimulus duration and intensity was automatic, using two Hunter decade interval timers in series. The stimulus sequences were photographed on motion picture film and put into the Perceptoscope, a 16 millimeter projector which provides automatic single frame projection without distortion. A Wollensak solenoid-operated shutter opened for two seconds, exposing a particular frame upon the screen. At the end of two seconds the shutter closed, the Perceptoscope moved the film to the next frame, and the interstimulus timer was activated so that six seconds later, the shutter opened again and the process was repeated. An automatic warning bell sounded two seconds before the shutter opening. The process could be reversed or halted at any time by the experimenter, so that given stimuli might be repeated when necessary.

3. Intensity Controls. Intensity controls were of two types. One of these involved manipulation of a variac. During an initial session, the zeroing-in period, the subject was required to locate accurately the signal being presented. The variac was lowered two volts after each of eight presentations. This procedure was continued until a point was reached at which the subject was consistently correct for five out of eight presentations. This involved lowering and raising

the voltage for the purposes of "zeroing-in," a procedure similar to that used with the Békésy audiometer. The variac was then fixed at this level. By this procedure, the different subjects were operating at comparable levels during the various tasks to follow.

A second method of intensity control was by means of polaroid rotation. A pair of polaroid filters was fixed directly before the shutters. During the zeroing-in period, the polaroids were fixed at 45° . This setting transmits 50% of the maximum light transmittable by these filters. By decreasing the angle of polarization, more light could be transmitted than the amount of light used to zero the subject in, and by increasing the angle of polaroids, less light could now be transmitted. Eight polaroid settings were used, in a pattern which was uniform for all subjects. Thus, each subject could be given tasks at stimulus levels which, although they varied from subject to subject, were each equally proportional to the subject's baseline. The order of polaroid settings, and order of stimulus locations were prepared according to a counter-biased sequence designed to minimize the effects of guessing (Goldiamond, 1955). The eight polaroid settings and the light transmittance are indicated in Table 1. They will be referred to as Stimulus Intensities 1-8 in the graphs which follow. It will be noted that they refer to settings which differ for each subject for light transmitted, but represent similar increments or decrements from each subject's baseline. The range chosen was designed to bracket the conventional psychophysical curve, with a minimum of responses at the 0 or 100% response asymptotes. One can present eight settings, three of which are so dim that response probability is zero, and three of which are so bright that response probability is 100%. Variation will occur over

TABLE 1

TRANSMITTANCES AT POLAROID SETTINGS

Stimulus Number	Degree	Percent Transmittance	Percent of Baseline (Approximate)
1	71.50	10.07	20
2	63.50	19.91	40
3	56.75	30.06	60
4	50.75	40.02	80
5	45.00	50.00	100
6	39.25	59.97	120
7	33.25	69.94	140
8	26.50	80.08	160

only two settings. The range chosen was designed to maximize the number of settings in which variability would occur, and to approach the asymptotes at the ends of the range.

4. Polaroid by Voltage Settings. The booth was calibrated by means of a Macbeth Illuminometer, and the foot candle readings at three polaroid settings for six variac settings are presented in Figure 1. At the setting of 90° polaroid, no light is coming from the projector, hence this gives the number of foot candles on the screen, that is, the lighting of the room with reference to the screen. Between 60° and 30° of polarization, the polaroid transmission curve is practically linear, symmetric around the 45° point of inflection. As can be seen from Figure 1, the readings on the screen tend to be in accord with the polaroid curves. The parameter is voltage.

5. Response Panel. The response panel of the subject contained four buttons arranged in an up, down, left, and right manner for the subject to press for the locational response. For the Yes-No response, there were two buttons, the one on the left to be pressed for a No response, and the one on the right to be pressed for a Yes response. A row of lights was directly above the two buttons. A light over the left button was lit when that button was pressed and two lights over the right button were lit when that button was pressed: one light when the button was pressed once, and two lights when the button was pressed twice. The order of the three lights was: the zero response, light one; 1 response, light one and two; and 2 responses, lights one, two, three.

B. Mobile Booth. The mobile booth and equipment were similar in all respects to the laboratory booth except for the lighting and the

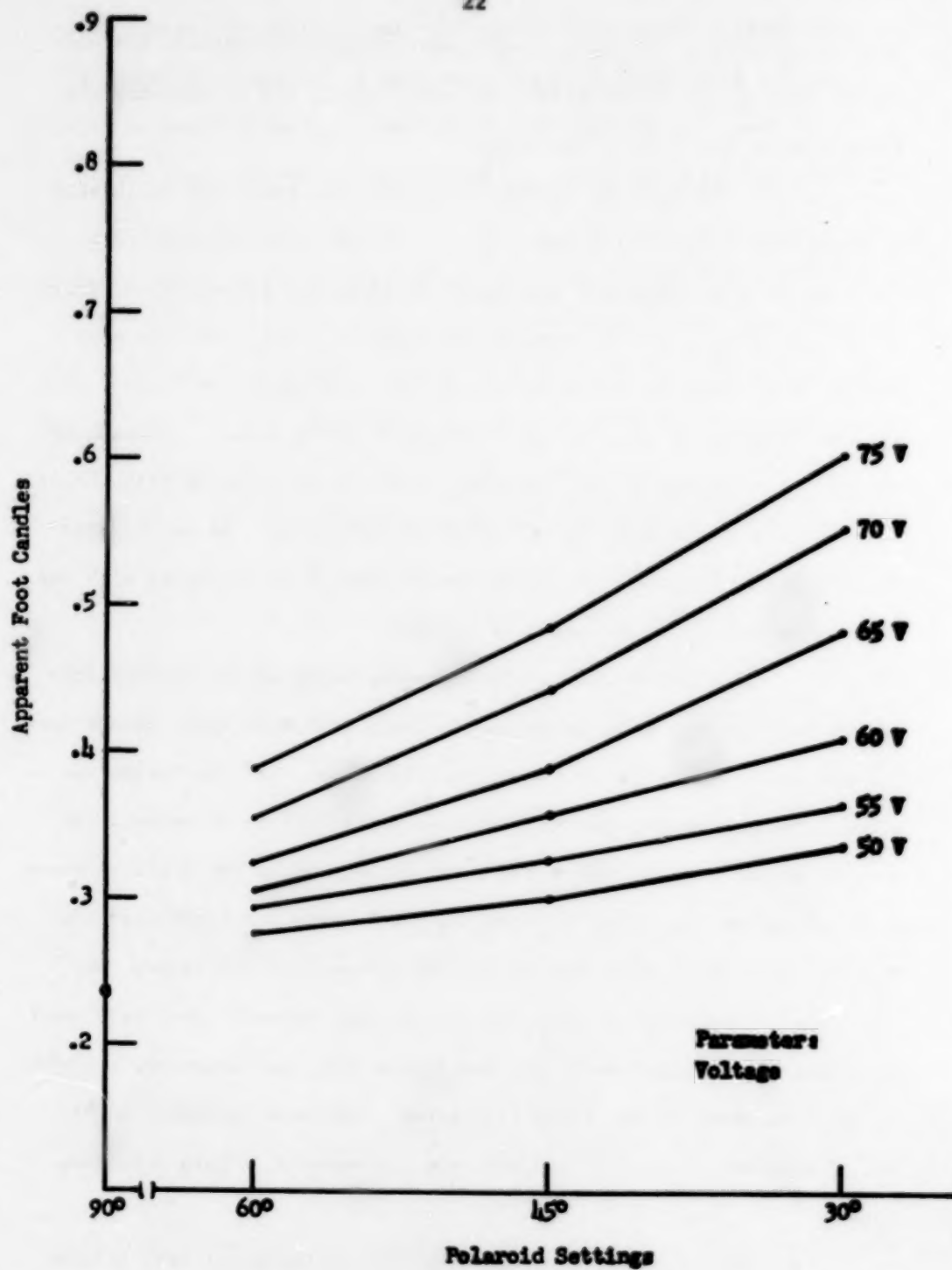


Figure 1.

Foot candle readings of screen in campus laboratory.

response panel. Calibration of the lighting in terms of polaroid settings at the different variac settings used is presented in Figure 2. As can be seen, the straight line functions expected in terms of polaroid transmission have been obtained. These differ from the curves of the campus laboratory, although they follow the same lawfulness. Tests were run on the same subjects, both in the laboratory and in the truck, to ascertain what this difference, and the differences in circle sizes to be presented, meant behaviorally in terms of signal detection functions (the Macbeth Illuminometer readings are behavioral calibration functions). It was discovered that identical curves were obtained when the truck illumination was reduced by eight volts, and this correction factor can accordingly be used to equate the two laboratories.

1. Response Panel. The response panel in the mobile laboratory differed somewhat from the response panel used in the campus laboratory. The accuracy response buttons were the same. For the Yes-No responses, three buttons were introduced, each with a light over them. The first button and light indicated zero, the second button and light indicated a response of 1, and the third button and light indicated a response of 2. The lights went on in the manner similar to that in the laboratory, that is, the button for response 2 lit both lights one and two.

C. Stimulus Sequences. The same film was used in both laboratories. For the size discrimination task, four circles were flashed upon the screen. The circles were a solid white against a black surround. When flashed upon the screen in the campus laboratory, the three large circles had a diameter of $2\frac{5}{16}$ inches and the small circle of $1\frac{5}{8}$ inches. From the center of the left circle to the center of the

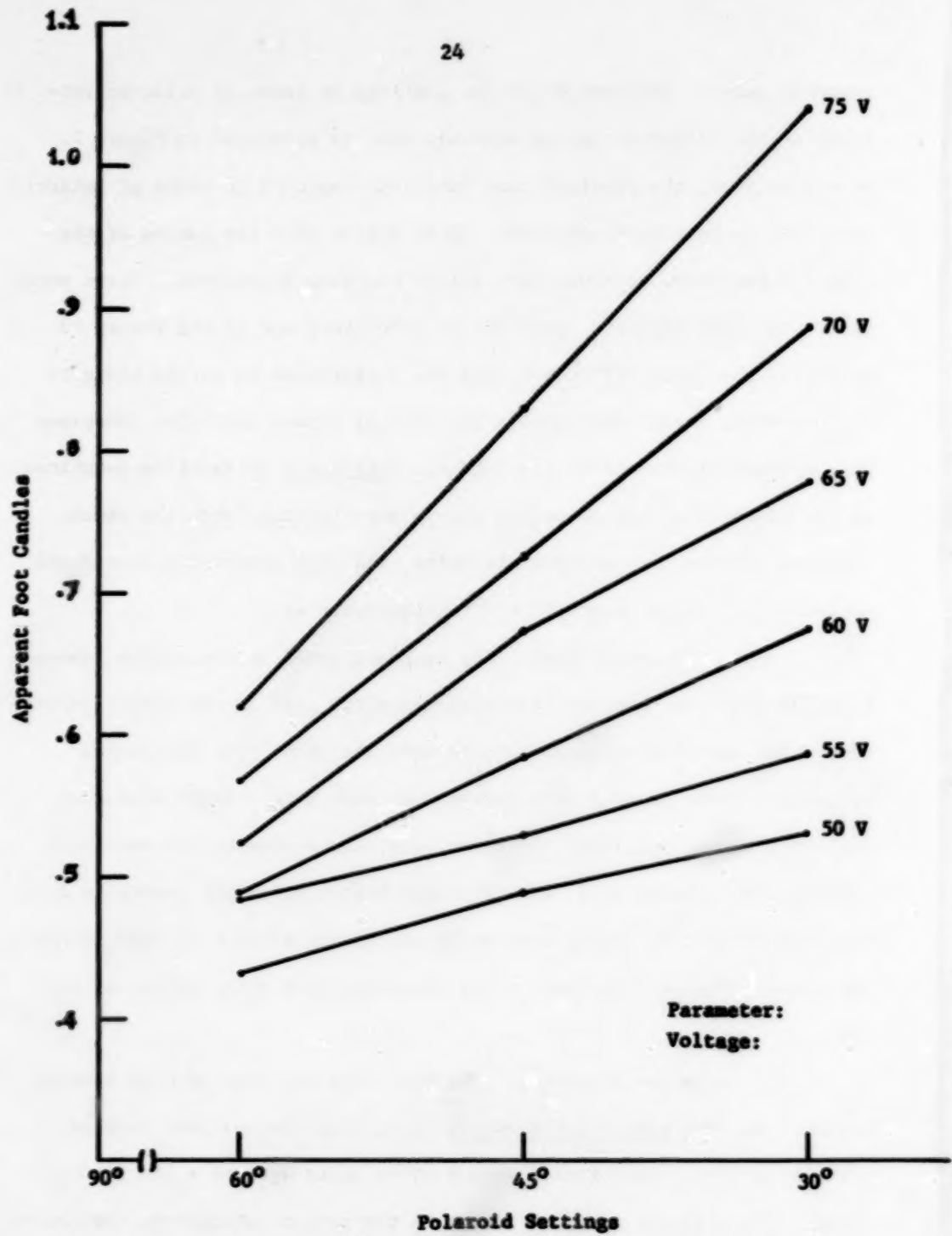


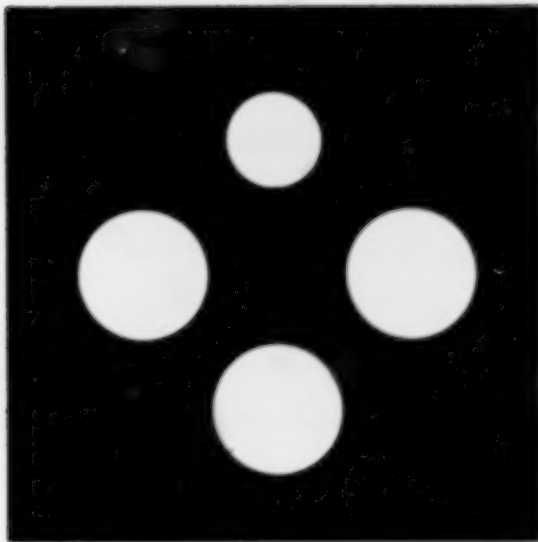
Figure 2.

Foot candle readings of screen in mobile laboratory.

right circle, the distance was $4\frac{3}{4}$ inches, and from the center of the upper circle to the center of the lower circle, the distance was $4\frac{3}{4}$ inches. In the mobile laboratory, the large circle was 2 inches in diameter, with other dimensions proportional. The stimulus sequences were so filmed that register of consecutive sequences did not differ by more than $\frac{1}{8}$ th of an inch on the campus screen. This meant that for all practical purposes, the four circles always appeared in the same positions. The small circle varied its position from one frame to the next, and was centered on the center of the large circle it replaced. In the absolute discrimination, the circle appeared in one of four positions and was the same size as the large circle in the size discrimination task, and was centered in accordance with the circles of that task. All that was visible to the subject, however, was one circle on a black surround. Size and absolute discrimination tasks are presented in Figure 3. These sequences were filmed for the project.

1. Instructions to the subject, Size Discrimination Tasks.

The subject was seated in the booth which had doors opening to the left and right of him, and was told that at any moment he wished, he could leave the booth by striking either of the doors which were closed by means of friction catches. After some initial discussion, the subject was told that four circles would be flashed upon the screen two seconds after a warning bell was sounded. When the warning bell was sounded, he was to look at the screen, and wait for it to light up. When the screen lit up, there would be a small circle and three larger ones present and he was to press the button corresponding to the position of the smaller circle. There were several practice sessions performed at full intensity until the subject was able to respond appropriately to



Size Discrimination



Absolute Discrimination

Figure 3.

Sample presentation from size and absolute discrimination tasks. The position is "Up" in each case.

the presentations. Following this training period, the subject was told that on occasion the stimuli would be so faint that he would not be able to see anything. He was nevertheless to examine the screen carefully and press the button corresponding to the position guessed. There was a brief practice session of this kind until the subject was responding automatically. The zeroing-in period was then begun.

Upon completion of the zeroing-in period, the experimenter instructed the subject that he would again make the responses that he had made before. This time, however, he was to make an additional response upon the presentation of the stimulus. With his right hand, he was to press the left button if he saw nothing at all during the presentation. If he had not seen the smaller circle clearly, but had based his judgment on a perceived difference, he was to press the right button once. If he had seen the smaller figure clearly, he was to press the right button twice. One or two lights above the button lit up. The subject could correct his responses at any time, subtracting one light by pressing the left button and adding one light by pressing the right button. In the mobile laboratory, the instructions were identical except that he was told to press the left button when he had seen nothing, the next button when judgment had been based on some perceived difference, and the third button when he had seen a difference. A similar correction could be made.

Each of the four buttons for the locational choice had a light above it which illuminated when the button was pressed and the four were arranged in the cross manner corresponding to appearance on the screen.

As regards the two panels, the major difference between their functioning was in terms of the buttons for the Yes (or rather two, one)

responses. In one case, there was one button pressed twice, and in the other case, two buttons pressed once. The functioning of the lights in both cases was identical.

2. *Position and Intensity Sequence.* Eight stimulus intensities were used for each subject, with Intensity 5 being the original point at which the zeroing-in was done. For each subject, Intensity 6 represented a 20% increment above his baseline, and the other intensities above and below the point were similarly proportional to the subject's own baseline. The actual psychophysical task itself consisted of 128 stimulus presentations scored on two sheets of 64 each. The orders were scrambled, and so arranged that each intensity followed every other intensity equally. Thus Intensity 1 was followed by 2 on one occasion and 3 on another and so on. This produced 64 presentations. Superimposed upon this control for intensity sequence was another control for sequence for lefts, rights, ups, and downs. A sequence based upon run statistics was used to arrange this schedule (Goldiamond, 1951). These precautions were necessary since response to one stimulus presentation in a psychophysical task is not independent of responses to other presentations. As a matter of fact, Sanders (1952) has noted that not only does the preceding response influence the present one, but has been able to trace an influence 14 responses back. This can be embarrassing in a sensory experiment, since the assumption is often made that the response is governed by the stimulus being presented. That it is also governed by the other responses produced introduces an extraneous variable which may contaminate the score. There are fundamentally two ways to attempt to resolve this problem. One is to use randomized sequences and hope that these effects cancel each other out statistically; the other procedure

is to attempt to build into the sequence control of the serial effect. The latter course was chosen.

3. Absolute Discrimination. The instructions and procedures for the absolute discrimination curve were analogous to those for size discrimination except that the subject was told that only one circle would appear in one of four positions.

4. Recording of Responses-Psychophysical Tasks. Each press of the button activated an appropriate light on the experimenter's control panel. In addition, there was a two-way communication system with the subject for verbal communication.

General Perception Room. All tasks other than the psychophysical tasks were run in a separate vision room adapted for such experimentation. In the mobile laboratory, a section of the trailer was converted into a room for such purposes. The tasks to be discussed in the following section were run in the appropriate separate vision rooms.

A. Size Constancy. In the size constancy task, the subject sat by the side of a small table, on which was a black stand. Small equilateral triangles made of white plastic were placed one at a time upon the stand. Seven triangles were used, their altitudes being 2.3, 6.1, 6.7, 11.5, 13.9, 16.5, and 21 centimeters. The order of the triangles was varied in a systematic manner in an effort to ascertain the effects of method on judgment. Orders will be discussed in the section on results. At the opposite end of the room was a black apparatus similar in principle to that utilized by Thurstone (1944). By turning a knob, a piece of wood painted black was made to move up and down in a black frame. On the wood was a large white plastic triangle. The amount of triangle exposed, that is, not hidden by the frame, depended upon how

far the manipulable unit was moved up. A centimeter scale on the back indicated the altitude of the triangle being exposed. The distance from the subject to the apparatus in the campus laboratory was eight feet; in the mobile unit it was four feet.

B. Mirror Judgments. A mirror two feet by two feet was utilized during another part of this experiment. Here the triangle apparatus was put close to the subject and the mirror was placed in the previous position of the apparatus, with the subject viewing the apparatus only through the mirror, and the test was then continued.

C. Rationale for the two Procedures. By providing the mirror, the distance was not only doubled, but certain visual effects were attained. In the regular situation, the subject might be able to use other cues in the room to help him judge the size of the triangle. In the mirror case, since the mirror will bring to the subject's eyes only light hitting it at the appropriate angle, and effect is obtained as though the apparatus were in a tunnel, with other cues barred. Accordingly, differences between results might reflect differences in distance and cues available.

D. Instructions and Procedure. The subjects were told that it was their task to have the instrument triangle be the same size as the triangle on their stand. The experimenter manipulated the variable triangle by turning a hidden knob, and they were to tell the experimenter *to stop when the triangle was the size of the one on their stand.*

E. Muller-Lyer Illusion. Twelve cards, each 11½ by 19 centimeters, were used for tasks involving Muller-Lyer Illusion. The figures used had the same proportions as those used by Thurstone with an extra card added at each end in order to lengthen the series. Each picture was

100 centimeters long. The side with the arrows enclosing the space (i.e. the one normally judged smaller) varied from 48 to 68 millimeters in steps of 2 millimeters. The first and last cards in each series are presented in Figure 4a.

In addition to having two extra cards, the procedure differs from Thorstone's in that the images were placed on separate cards rather than being placed on one sheet. This enabled the experimenter to rearrange the orders of the cards, and thereby to test the effects of different orders and instructions upon judgments. The cards were on white Strathmore bond enclosed in plastic.

F. Titchener Circles Illusion. The Titchener Circles Illusion was drawn on 17 separate cards. This illusion consists of two groups of circles side by side. In one group, a small reference circle is surrounded by five large circles. In the other group, a variable reference circle is surrounded by eight smaller circles. The subject's task involves the equality of the two reference circles. All circles are constant except the circle surrounded by the smaller ones, which varies in size from one card to the next. In the non-variable group, each of the five larger circles was 23½ millimeters in diameter. The center circle was 14½ millimeters in diameter with the distance between radii of center and surrounding circle being 12 millimeters, in accordance with the figures used by Thorstone. In the variable group, the small circles were each 8 millimeters in diameter. The variable circle inside them ranged from 9 to 21 millimeters, in steps of .75 millimeters. The first and last cards in each series are presented in Figure 4b.

Again the task differs from that used by Thorstone in that the illusions were placed on separate cards, enabling alteration of the order,

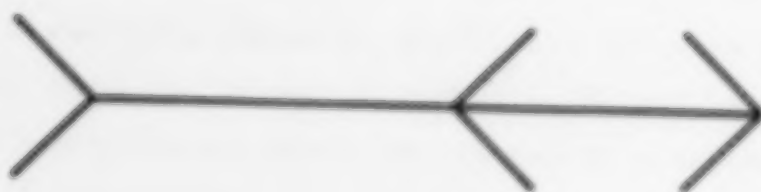


Figure 4a.

First and last cards of Muller-Iyer series used (line 4 in. long).



Figure 4b.

First and last cards of Titchener Circles Illusion series used (same scale as 4a).

which was a variable in this experiment.

G. Muller-Lyer and Titchener Illusions Compared. Both of these illusions were utilized since Wapner and Werner (1957) report different developmental functions for each. They report that the Muller-Lyer Illusion decreases with age, and that the Titchener Circles Illusion increases with age. It was accordingly felt that if this were a developmental function, it might relate to the intelligence quotient.

H. Streeter-Gestalt Test. Drawings from the Streeter-Gestalt test utilized by Thurstone were printed on cards of 7 by 11½ centimeters which were then centered on cards of 10 by 15 centimeters. These consist of black and white pictures, parts of which have been erased, with the subject required to tell what the picture is. The number of cards recognized by the subjects within a given time limit was used as the measure here. Since one of the factors in this test is considered to be a perceptual timing factor, a reaction time apparatus was also used.

I. Reaction Time. Confronting the subject was a small panel modified from the Stoolting reaction time apparatus containing a buzzer, a red light, and white light. The subject had his finger on a button prior to each trial. When the buzzer or either light went on, the subject was instructed to turn it off immediately by pressing another button. Reaction time was broken down into two separate measures, following a procedure of Palermo (1934). The amount of time between the onset of the discriminative stimulus and the subject lifting his finger from his key was measured by one Standard Electric timer, and the amount of time between lifting the finger off the key, and turning the discriminative stimulus off was a second measure, measured by a second Standard Electric timer. Both of these added together constitute the reaction time measure.

usually used. In this case, they are broken down to reaction time to discriminative stimulus and time to move the finger.

J. Color Vision. The revised M.L.L. Pseudochromatic plates (1957) were used to test color blindness in the various children, since the relationship of color blindness to retardation is apparently an open question. These involve location and identification of geometric figures rather than numbers, and are also distinguished by the fact that all plates are identical except for color.

K. Sight Screener. The standard battery of the American Optical Company Sight-Screener was also run on every child. These consist of tests including visual acuity, phorias, and depth perception.

Subjects. The subjects were children from schools in Southern Illinois, and details concerning their procurement, bases for selection, and classification according to intelligence quotient are covered in the section of this report by Dr. Halpern. Elementary school children from schools of various towns in Southern Illinois were chosen from normal and EMR classes and equated for age, sex, and town. Children at the Lincoln School were matched on the basis of age and sex. Not all subjects tested clinically are included in the main body of this study. Certain of the subjects were utilized to test apparatus and alter procedures. Illnesses and withdrawals eliminated others. Finally, on the psychophysical tasks, it proved impossible to run 20 subjects on both tasks because of time limitations involved in running them. Where data for one task were, however, obtained, these proved to be no different from similar data obtained by other children in the same group. The number of children tested on the tasks of this experiment, and whose data constitute the results to be discussed are presented in Table I,

TABLE 2

NUMBER OF SUBJECTS IN PSYCHOPHYSICAL TASK (SIZE DISCRIMINATION)

Age	Normal	DM	DM	Total
8-9	9	6		15
10-11	11	15	13	39
12-13	17	10	16	43
14-15	6	6	4	16
16	3	6		9
Total	46	43	33	122

IQ	Non-institutionalized	Institutionalized	Total
Under 60	6	6	12
60-74	24	24	48
75-89	17	3	20
90-104	12		12
105-119	13		13
Over 119	13		13
Total	89	33	122

which presents figures for the psychophysical tasks, and Table 3, which presents figures for the other perceptual tasks.

Summary of Procedures. A battery of tests is described which was utilized for subjects of various chronological ages and intelligence quotients. These tasks have in common their association with visual perception, but differ in certain marked aspects.

The rationale underlying the use of this battery of tests is related to an experimental analysis of the perceptual response. Contributing to the variance of the perceptual response is not only variance from that relationship between the discriminative stimulus and the response, which is known as perception, but variance from a variety of other sources which can be considered as extraneous to perception. In the case of alleged perceptual reaction time, for example, the question arises as to whether the slowness of the response is to be attributed to slowness of perception or the slowness of the observable response.

This rationale underlies the various tests chosen. In the psychophysical tasks, two differing responses were chosen, both occasioned by the same discriminative stimulus. Accordingly, differences between these responses can be considered perceptual, since the same stimulus is being presented at the same time. Analysis of these curves might indicate to what extent the differences found among the various curves could be related to difference in signal detection and differences in other variables studied in decision theory and operant conditioning. Similarly, two different psychophysical tasks were utilized. One involved size discrimination and the other absolute discrimination. The absolute discrimination is characterized by the absence of reference points found in the size discrimination task. The relationship between curves ob-

TABLE 3
NUMBER OF SUBJECTS IN PERCEPTUAL TASKS

Age	Normal	ENH	DMH	Total
8-9	9	6		15
10-11	12	17	19	48
12-13	19	10	26	55
14-15	5	6	5	16
16	3	5		8
Total	48	44	50	142

IQ	Non-institutionalized	Institutionalized	Total
Under 60	7	15	22
60-74	24	30	54
75-89	17	5	22
90-104	15		15
105-119	15		15
Over 119	14		14
Total	92	50	142

tained for these two tests may indicate the effects of a reference point upon psychophysical response.

While the psychophysical tests seem to be cumbersome in terms of the amount of time, equipment, and precision involved, they are characterized by very simple discriminative stimuli. In contrast, the simply administered, simply instrumented Gestalt-type tasks involve rather complicated visual stimuli. Again, differences between performance on these tasks might bear on problems of complexity, simplicity, stimulus-specificity, and the like.

The rationale of the experiments to be described can be summarized in terms of their attempt to disentangle from the perceptual response contributions from perceptual variables, and variables extraneous to perception, and to relate these to the developmental variables of chronological and mental age as reported in the intelligence quotient. Such differentiation might prove of value in the assessment of mental retardation. In addition, psychophysical curves have generally not been used for children and the study might cast some light on the extent to which generalization can be made to children from the voluminous literature on adult populations. In addition, other questions raised may have bearing upon perceptual methodology.

CHAPTER IV

RESULTS

Results of the various experiments will, in general, be presented as functions of chronological age, intelligence quotient, and population group. Chronological age has been broken down into five categories: under 10, from 10 through 11, from 12 through 13, from 14 through 15, 16 and over. To maintain uniformity with the auditory data, intelligence quotients have been grouped as below 60, 60 to 74, 75 to 89, 90 to 104, 105 to 119, and above 119. The three population groups are normal school children, children in classes for the educable mentally handicapped (EMH), and institutionalized children at Lincoln, Illinois (IMH).

Regarding the presentation of scores as a function of age, certain comments should be made. If the curves of all three population-groups are similar, and vary systematically with age, then it would seem that some kind of maturational relationship is involved. If there is a systematic relationship between chronological age and scores, and group curves systematically differ in a specified manner, then IQ may be involved. The specified manner is the following. If the curve is an ascending one, that is, performance increases with age, and the mentally retarded groups are consistently below the normal group at each point, this may indicate a relationship with IQ, just as a descending curve, with the mentally retarded curves above the normal curves might indicate a similar relationship. The reasoning behind these relationships is

apparent from the nature of the IQ, which gave an index of the average performance of children at a given age. Thus, if performance in some task improves with age (for example, size of vocabulary), the normal child will add more words with each year producing a rising curve for vocabulary. A child with an IQ of 50 would have a smaller vocabulary than his peer but this would also increase with age. Accordingly, a series of curves indicating an ascending relationship with age, with retarded children performing lower than normals at each age, would suggest a functional relationship with the intelligence quotient, just as a declining function, with the retarded children scoring higher at each age (as a possible example, reaction time) would also suggest a relationship to intelligence quotient.

In general, curves presented will be for both age and intelligence quotient.

Psychophysical Data.

A. Varies Settings. Each psychophysical experiment, it will be recalled, began with an attempt to equate each child's performance to a comparable level, during a serving-in period. This level involved the point at which the child was reliably able to locate the circle (absolute discrimination), and the point at which he could locate the smaller circle (size discrimination) for five out of eight trials (50% correctness above chance). The variac was lowered systematically until such a response point had been attained, raised again and lowered in a manner similar to that used in audiometric procedures involving the Békésy audiometer until a point considered reliable was obtained. Since the variac controls voltage and voltage is related to brightness of the light, these settings give us a comparative measure of the amount of

stimulus energy required by the child to perform at this level. Figure 5 presents the average voltage settings for the subjects as a function of chronological age for the size discrimination task. The curves of the institutionalized children have been corrected for differences between equipment. As can be seen in this figure, the three curves overlap. Further, the amount of stimulus energy required to score according to criterion seems to follow a negative slope, that is, the energy needed decreases as a function of age. In Figure 6, these curves are presented as a function of IQ. The scoring-in point is apparently independent of IQ. The drop for institutionalized subjects may be a function of the population, since this point represents only three subjects. Similar curves are presented for the absolute discrimination task in Figures 7 and 8, and the same results seem to hold. Neither of these functions would seem to be related to intelligence quotient, but do seem to be related to chronological age.

Accordingly, it would seem that the amount of stimulus energy required to make a correct location, whether this is of a small circle when compared with large circles or a single circle which varies in position, is independent of the intelligence quotient of the subject making the response. On the other hand, such energy level may be dependent upon chronological age. If we regard the ability to perform at a lower intensity level as better discrimination than similar ability at a higher intensity level, then discrimination of this kind may improve as a function of age.

It will also be noted that when voltages for absolute discrimination are compared to voltages for size discrimination, the former tend to be lower than the latter. It should be easier to distinguish presence

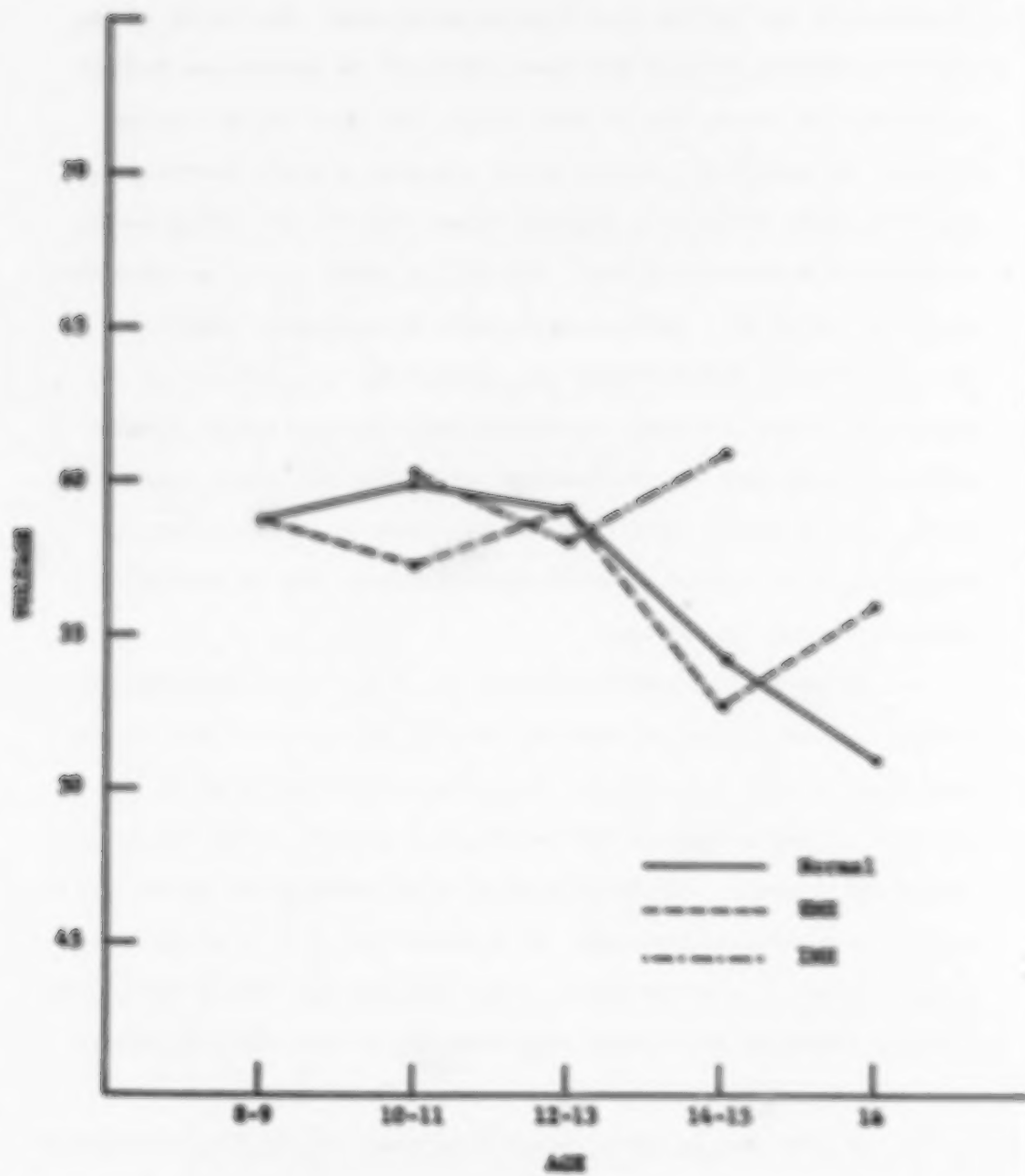


Figure 5.

Voltage for size discrimination servoing-in as a function of age.

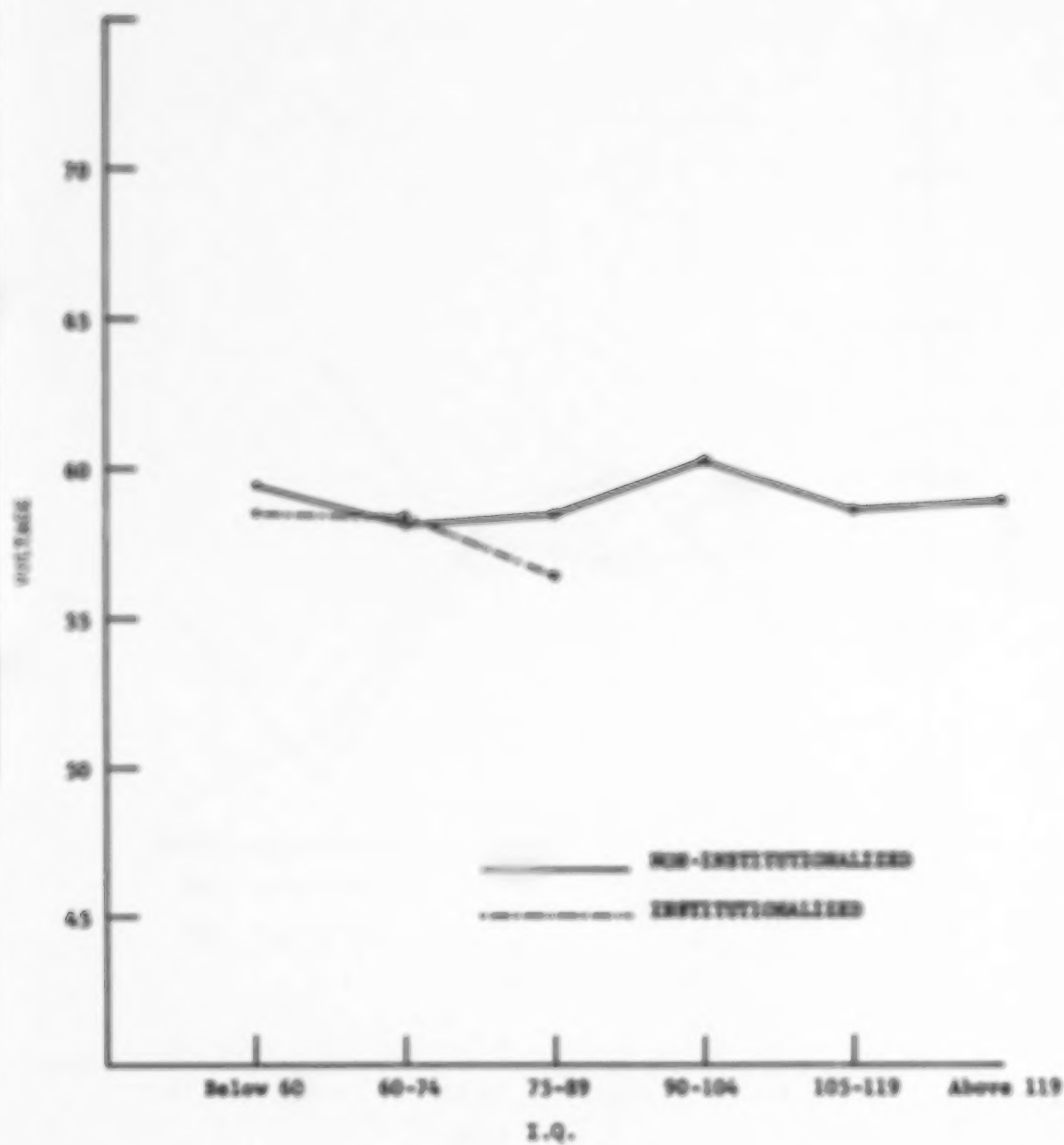


Figure 6.

Voltages for size discrimination serving-in as a function of I.Q.

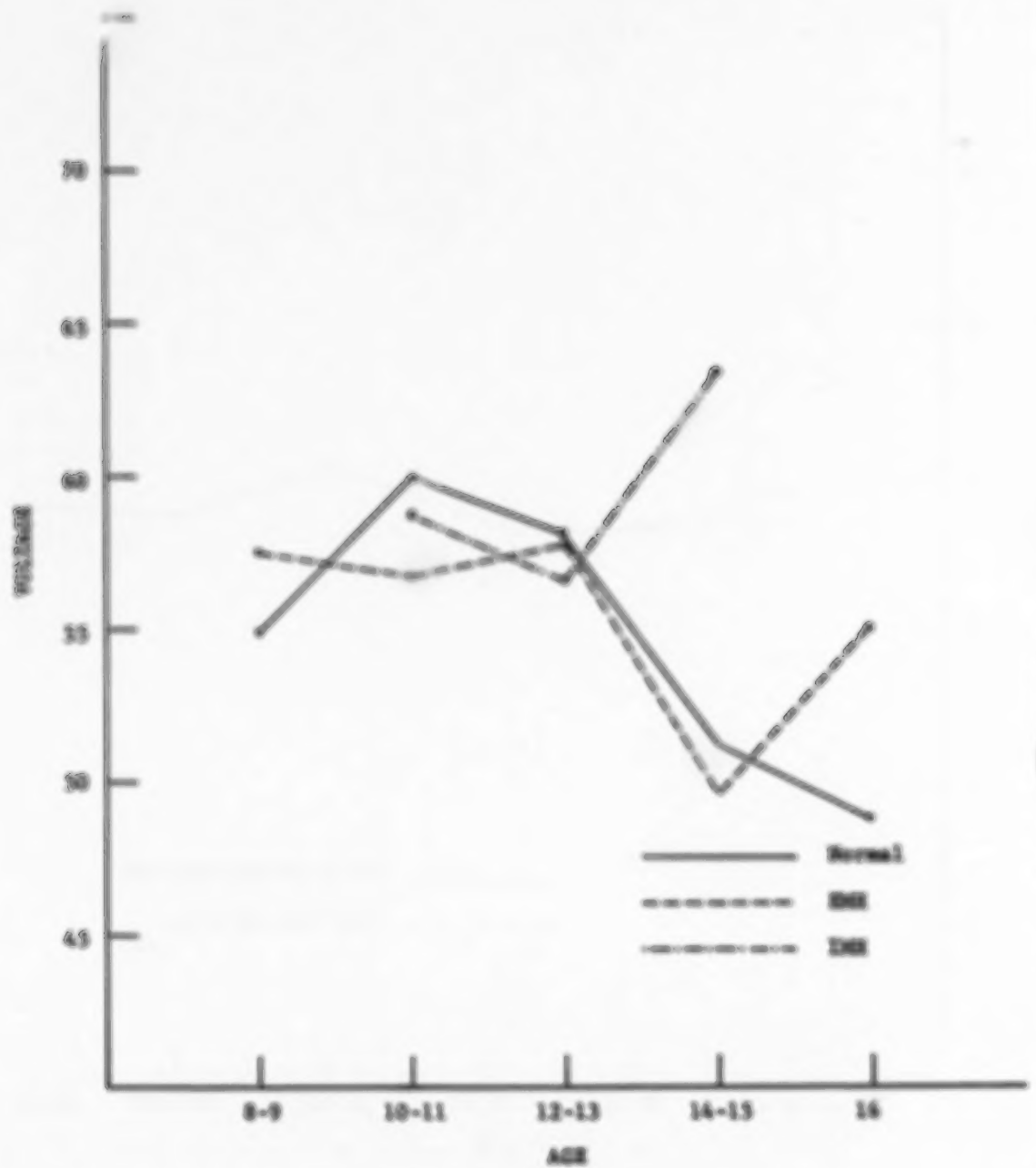


Figure 7.

Voltages for absolute discrimination serving-in as a function of age.

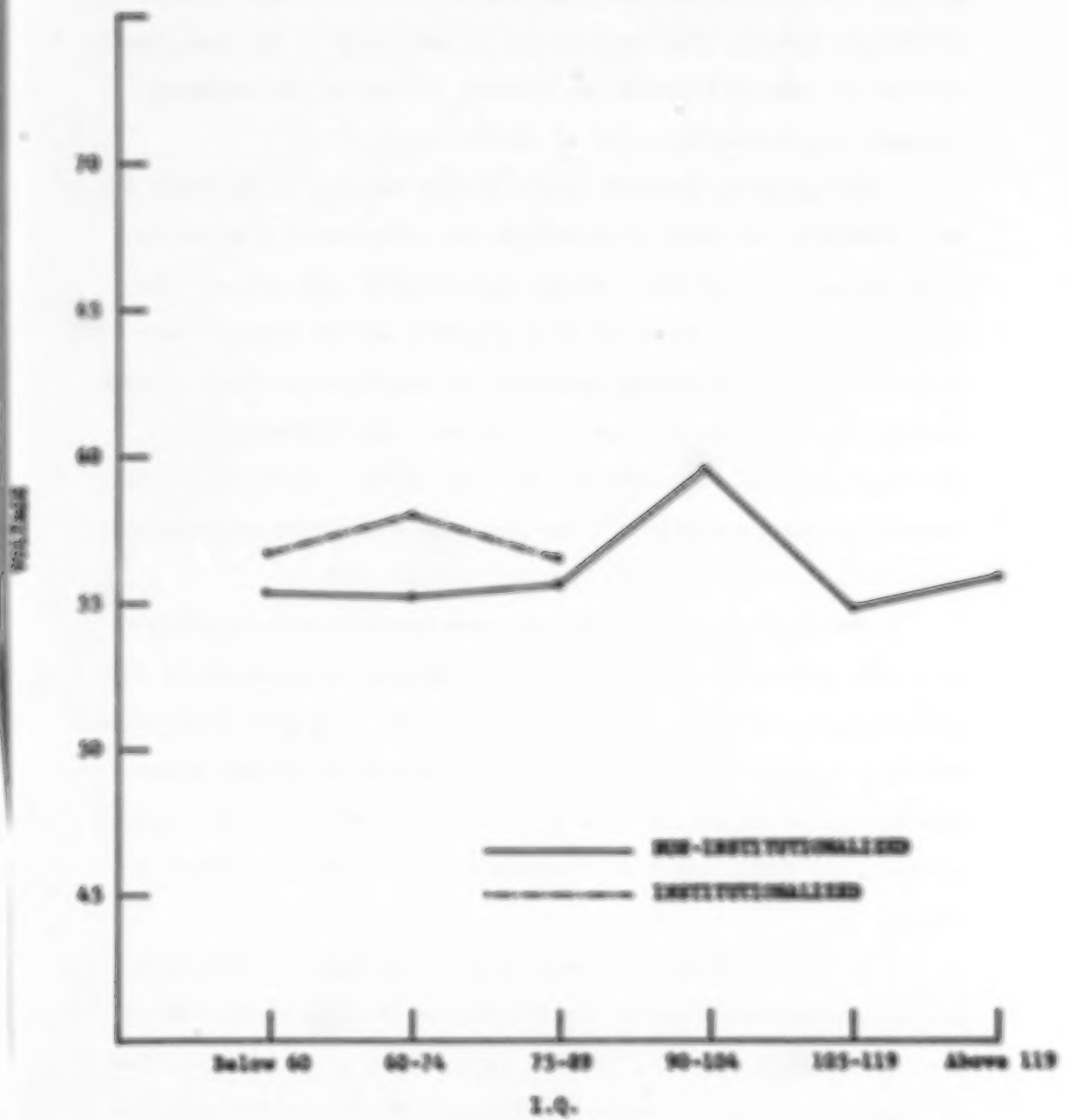


Figure 8.

Voltages for absolute discrimination serving-in as a function of I.Q.

from obscure (obscure) than large from small, where obscure is the smallest one can get, and that data confirm this. It should also be remembered, however, that the response in both cases is the same, usually five out of eight discriminations correct, so that at the differing voltages, recognition should be at similar levels.

Following the equation of the various subjects on the basis of this carrying-in criterion, each subject was subjected to a series of presentations in which both location and intensity were varied. The sequence of locations and order of intensities was the same for each subject, and the proportional increases and decreases in energy at each location were also the same for each subject. The following data, accordingly, do not deal with what has been called classically the subject's "absolute sensitivity", but deal with comparative performances around points initially equated for the various subjects.

Two psychophysical curves were obtained from each subject for each task, giving almost 100 curves. Parenthetical presentation of such data presents a problem. Accordingly, two types of graphic presentation have been employed. One involves the presentation of average psychophysical curves for groups being discussed. The other involves presentations of the total number of responses over all eight intensities for groups.

2. Psychophysical Accuracy Curves: (a) Size discrimination. Average psychophysical curves for accuracy of location of the smaller circle for normal subjects, with the parameter being age, is presented in Figure 9, and similar curves for DNH and DNH subjects are presented in Figures 10 and 11, respectively. These curves do not indicate differences in mean intensity values, since these are presented in Figures

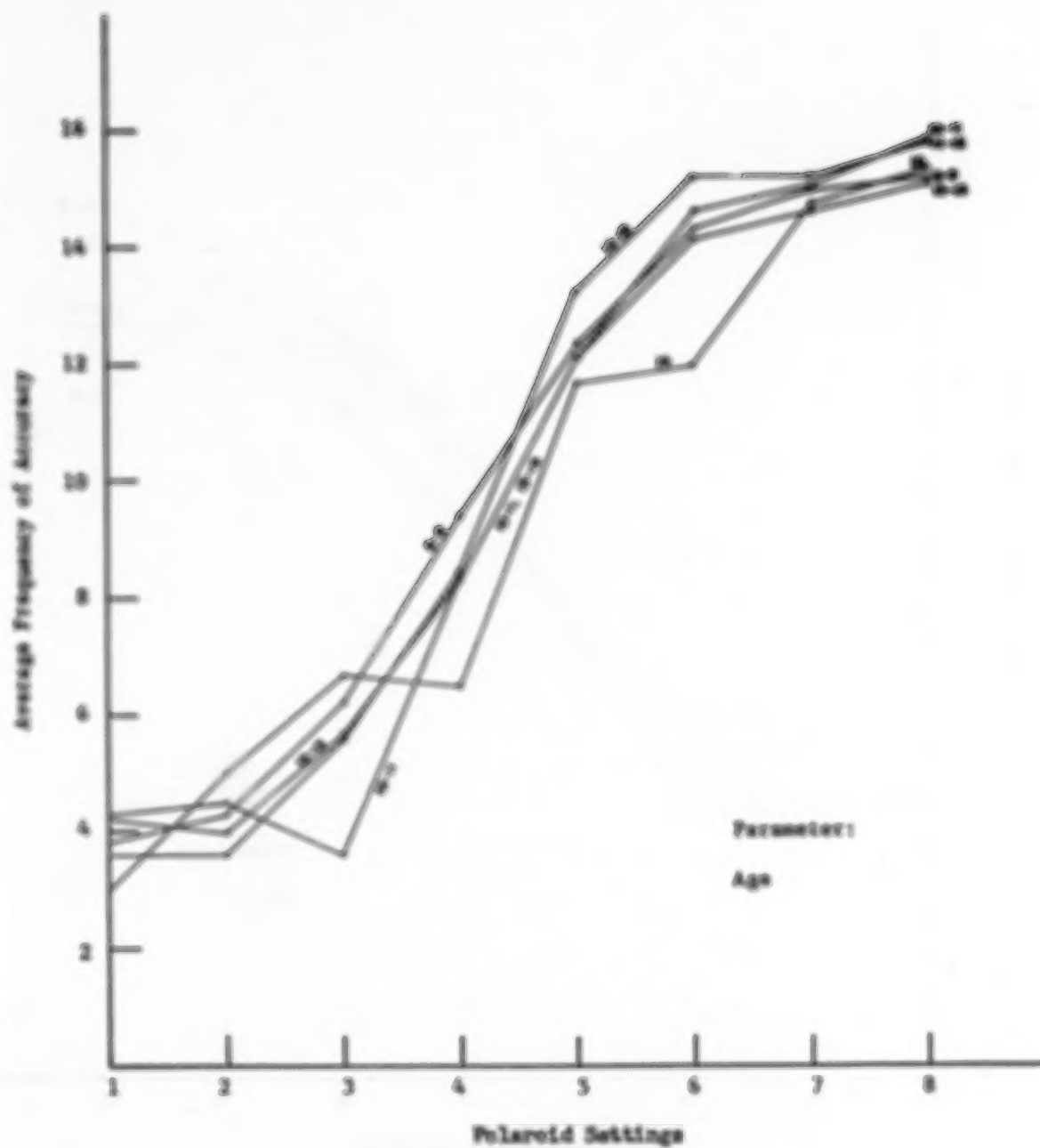


Figure 9.

Accuracy: Size-discrimination, normals, by age.

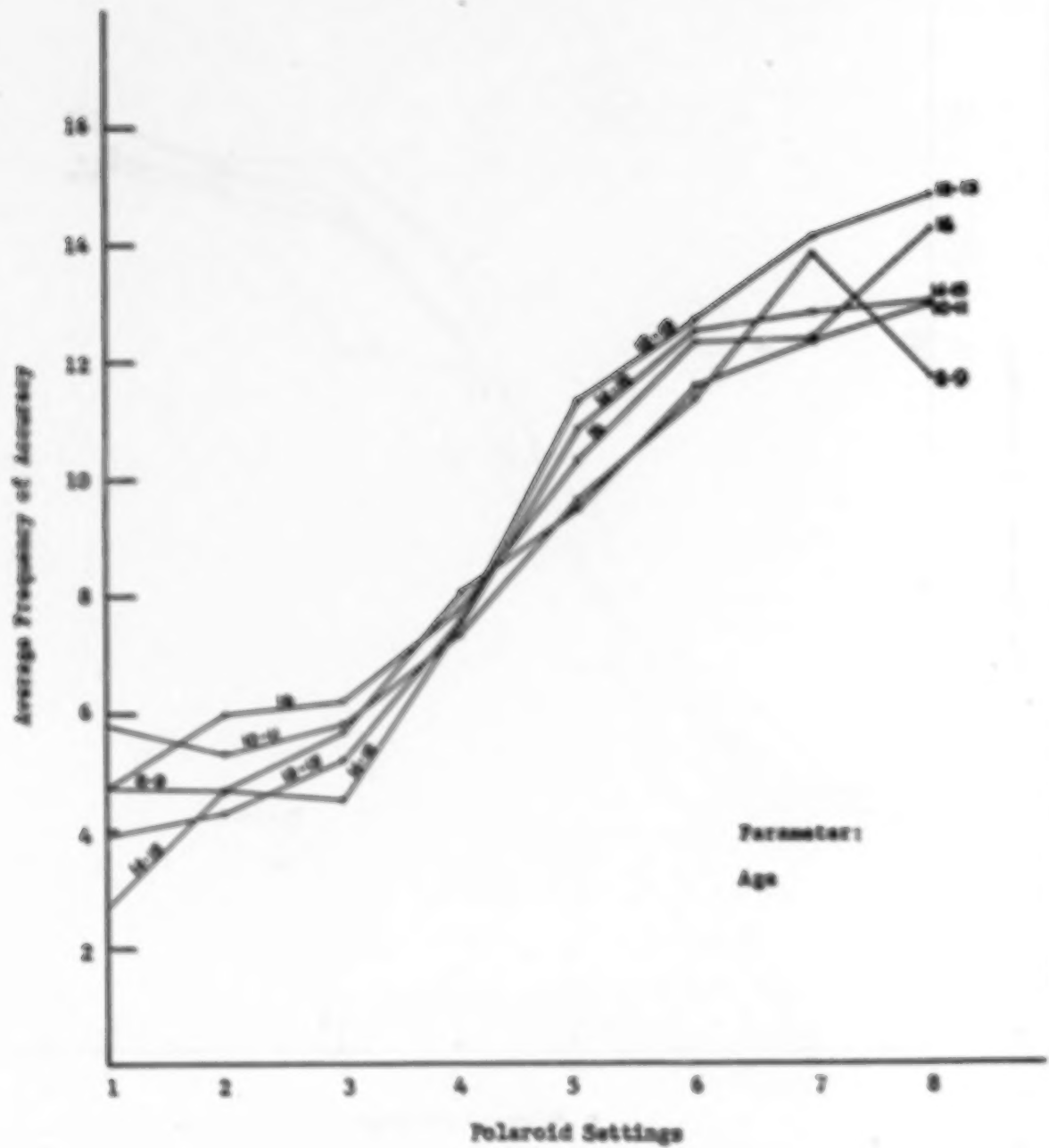


Figure 10.

Accuracy: Size-discrimination, E.M.E., by age.

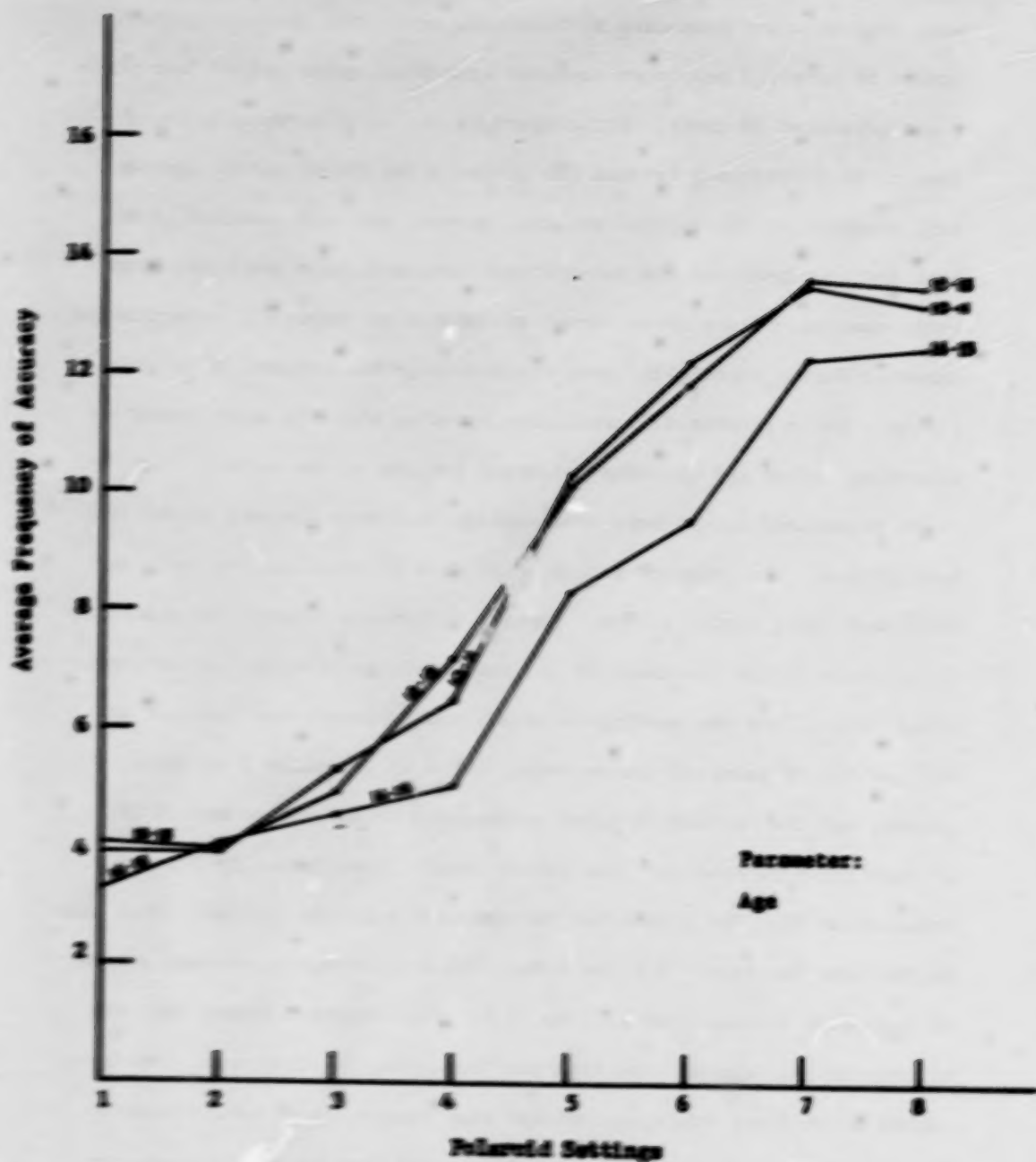


Figure 11.

Accuracy: Time-discrimination, I.M.H., by age.

5 and 6. What they do indicate is differences in dispersals around the mean values of those figures. It will be noted that all curves tend to have four accurate responses as their low asymptote, this being the number of accurate responses expected by chance, given one of four positions presented 16 times. With regard to the upper asymptote, there seem to be differences between the groups. The normal curves approach full accuracy at the highest setting, whereas with the retarded groups, both institutionalized and non-institutionalized, this point tends not to be reached. Since these curves are related to dispersals around means obtained during zeroing-in, such results could be obtained if retarded subjects had a greater dispersal than normals, with the upper asymptote extending beyond the uppermost polaroid setting of the series. For the lower asymptote, almost zero transmission will have the same effect for both groups. The range of settings, it will be recalled, had been established using normal adults. Another difference between the groups is to be found in the constancy of the zeroing-in point around which variations occur. For the zeroing-in point, the polaroids had been set at 45° , or 50% of polaroid transmission. This is Intensity 5 on these graphs, and the zeroing-in point corresponds to 10 correct out of 16. If this point is constant, the curves should cross Intensity 5 at an accuracy of 10. The graphs for the retarded subjects indicate that this is the case for them. For the normal children, however, average scores at Intensity 5 range from 11.5 to 13.5. This suggests either that the zeroing-in settings were too high for them, that is, they could have been zeroed-in at lower voltages, or that they learned to be more accurate as the experiment progressed. No clear relationships can be drawn between performance and age.

Similar curves, with the parameter being IQ are presented in Figures 12 and 13, dealing with noninstitutionalized subjects (normals and EMH) and institutionalized subjects, respectively. It will be noted in Figure 12 that there seems to be a difference between IQ's below 90 and those above, the latter producing higher scores. This may be related to the non-constancy of the zeroing-in point noted previously for normals, since this group is well above 10 accurate at Intensity 5. In Figure 13, the higher IQ's do worst, but again, the curves of this group tend to straddle the 10-score, as do those of the EMH children in Figure 12.

(b) Absolute discrimination. Discrimination curves for the white circle against a black surround are presented for normal, EMH, and IMH subjects, respectively in Figures 14, 15, and 16. It will be noted that in this task, the initial Intensity 5 input of 10 correct is seldom attained, and when it is, it seems to be with the older subjects only. If learning was involved in the elevation in the scores of normals noted for size-discrimination, it is not evident here. Further, reaching the upper asymptote tends to become rare, and tends to be attained by older subjects. Considerations regarding dispersal, similar to those made for size discrimination, may be entering here. The curves are definitely intensity functions, but the task seems to be far more difficult than the size discrimination task. This suggests that this type of discrimination may have greater dispersal around its mean, or greater response variability, for the conditions of this experiment, than the size discrimination task.

In Figures 17 and 18 the same data are presented with the parameter being IQ. The relationship of accuracy of location to IQ seems

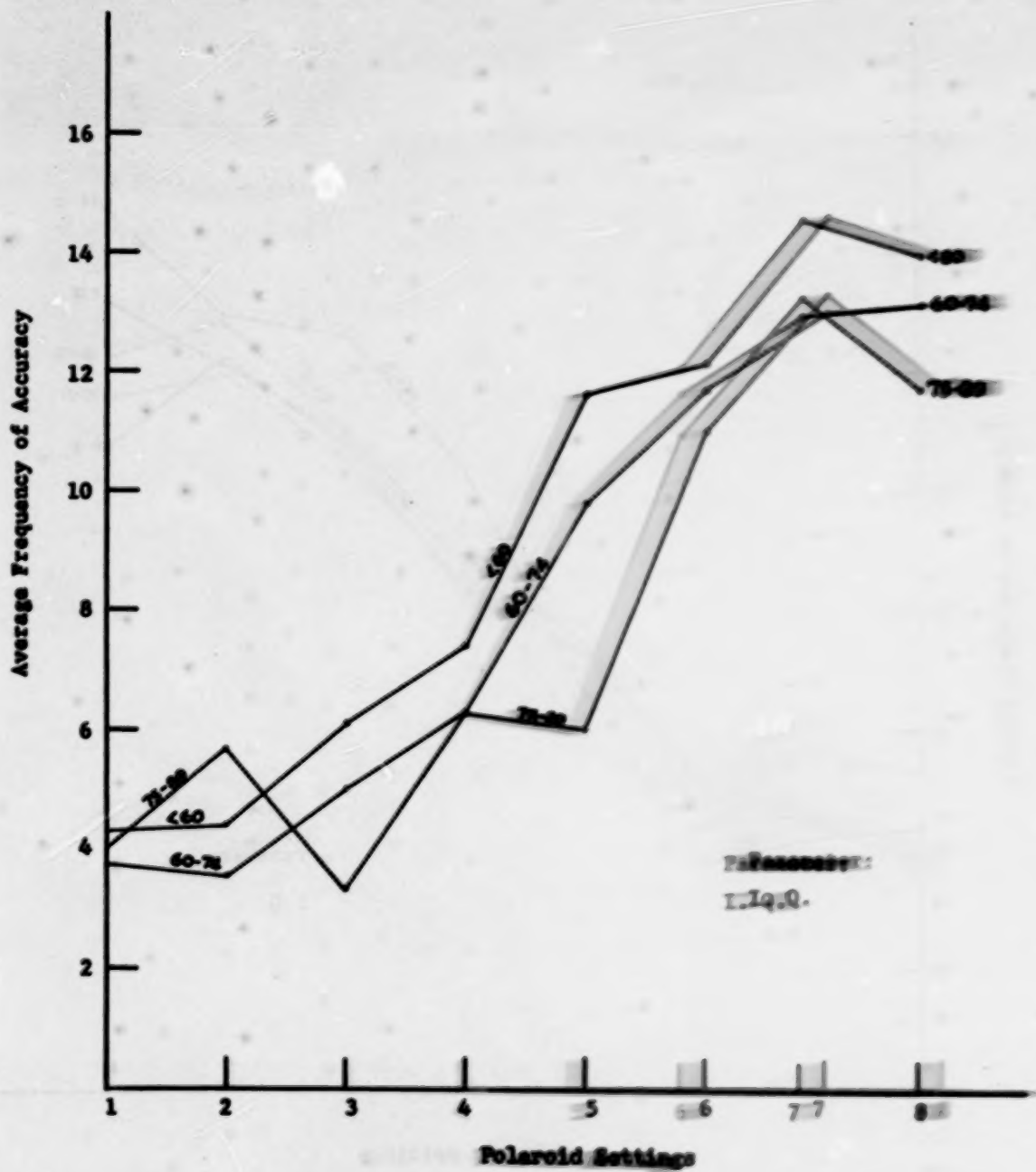


Figure 13.

Accuracy: Size-discrimination, institutionalized, T.Q.Q.

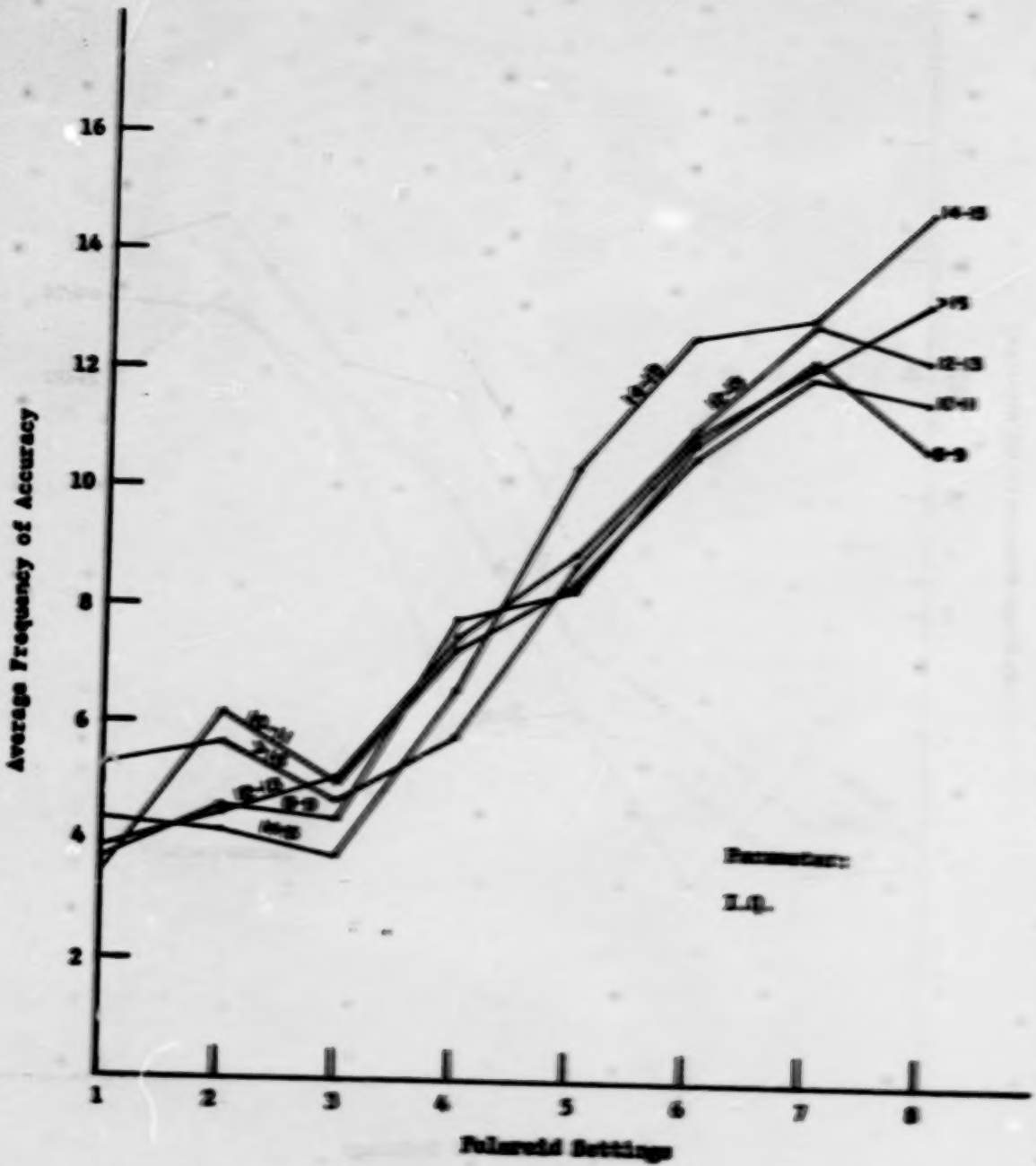


Figure 1A.

Accuracy: Absolute discrimination, words, by age.

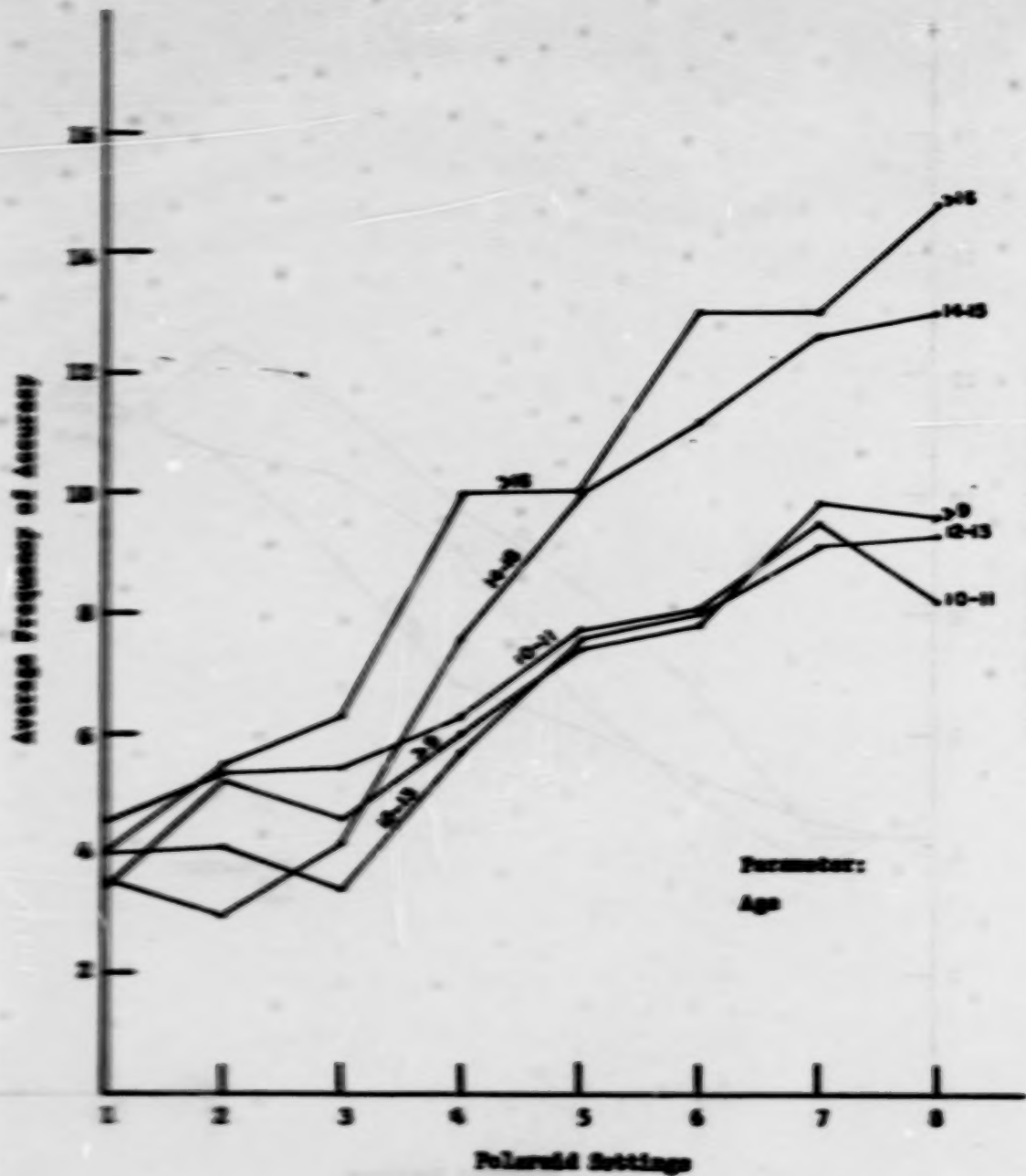


Figure 15.

Accuracy: Absolute-discrimination, S.H.E., by age.

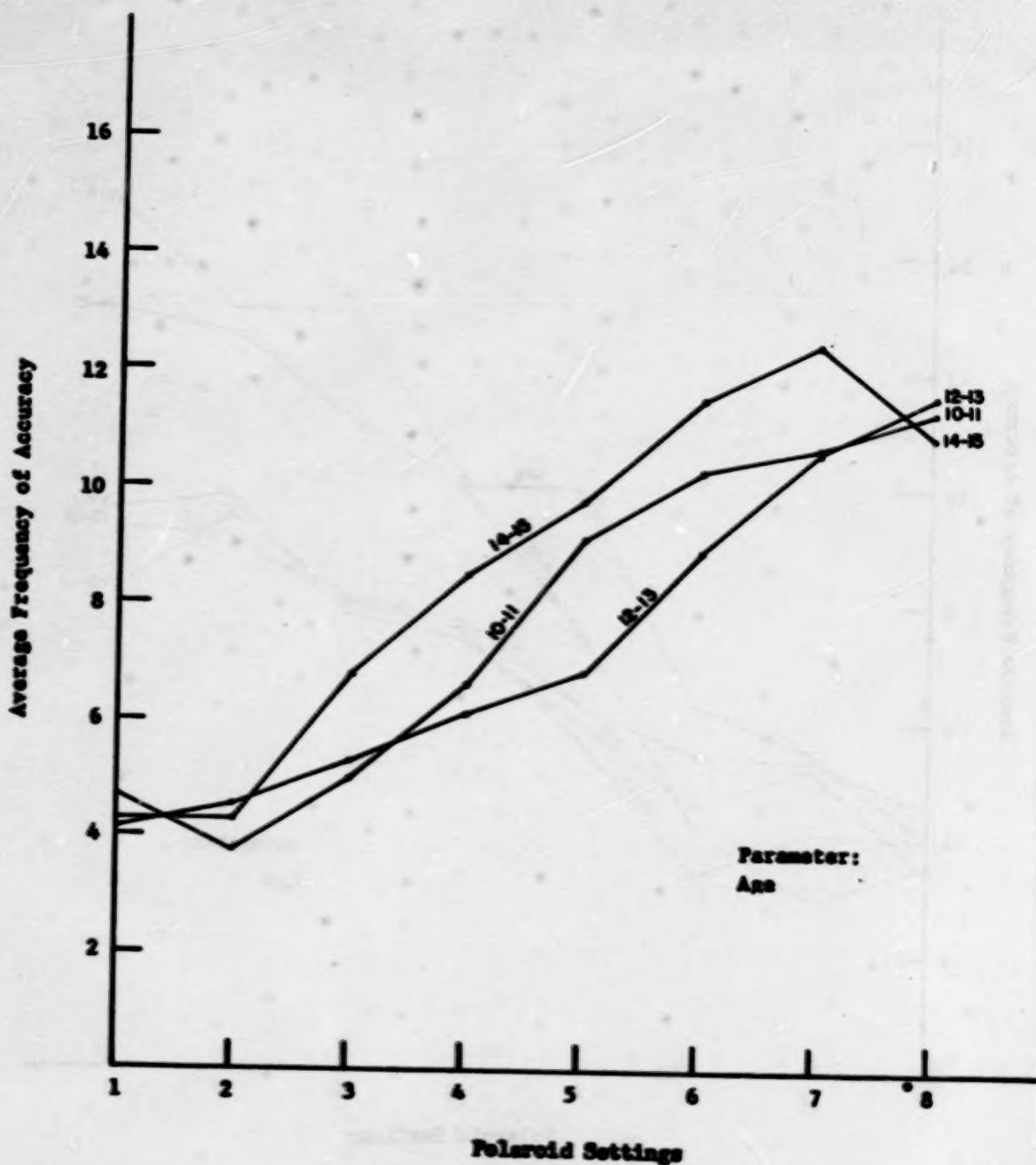


Figure 16.

Accuracy: Absolute-discrimination, I.N.H., by age.

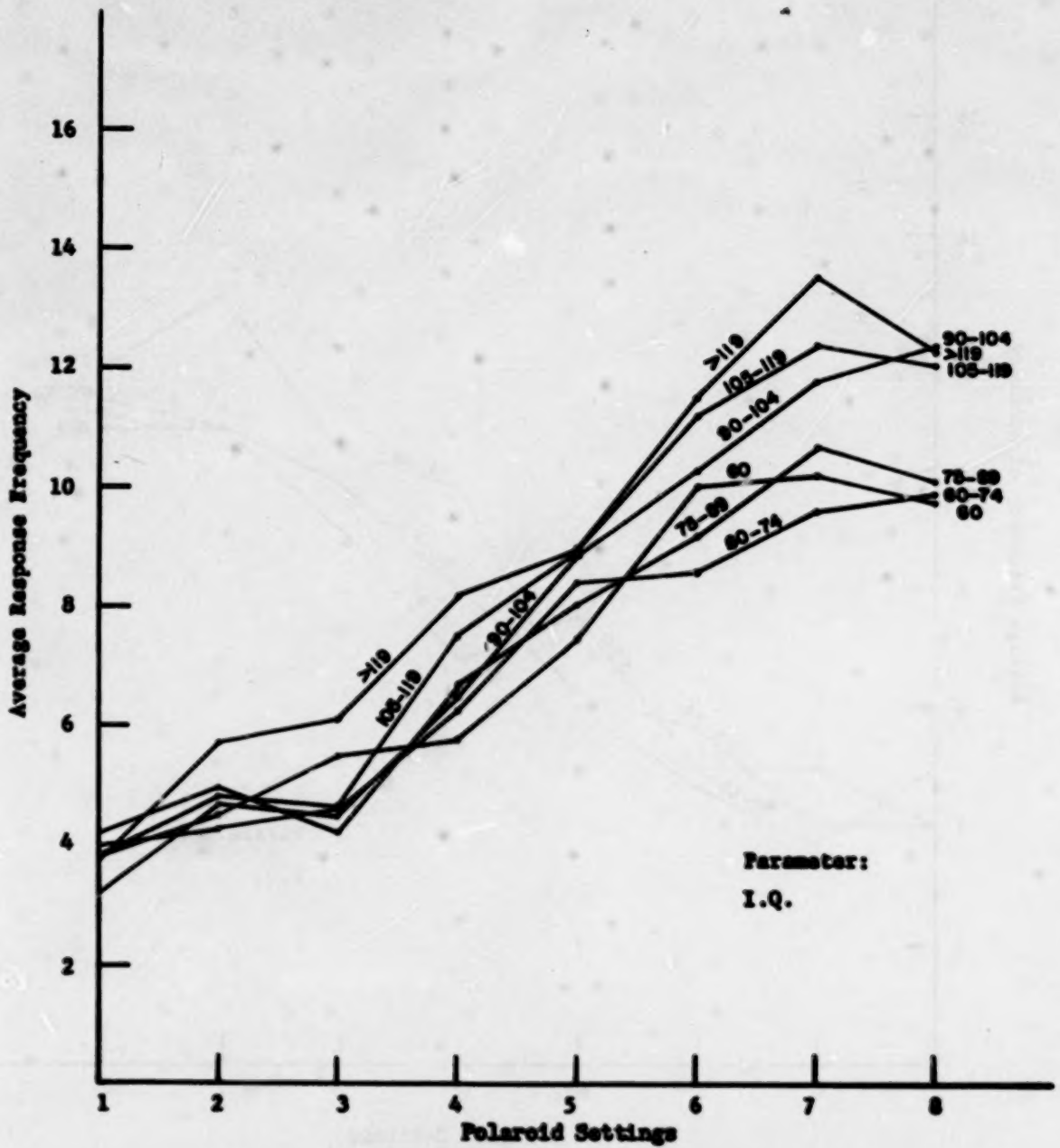


Figure 17.

Accuracy: Absolute-discrimination, noninstitutionalized, by I.Q.

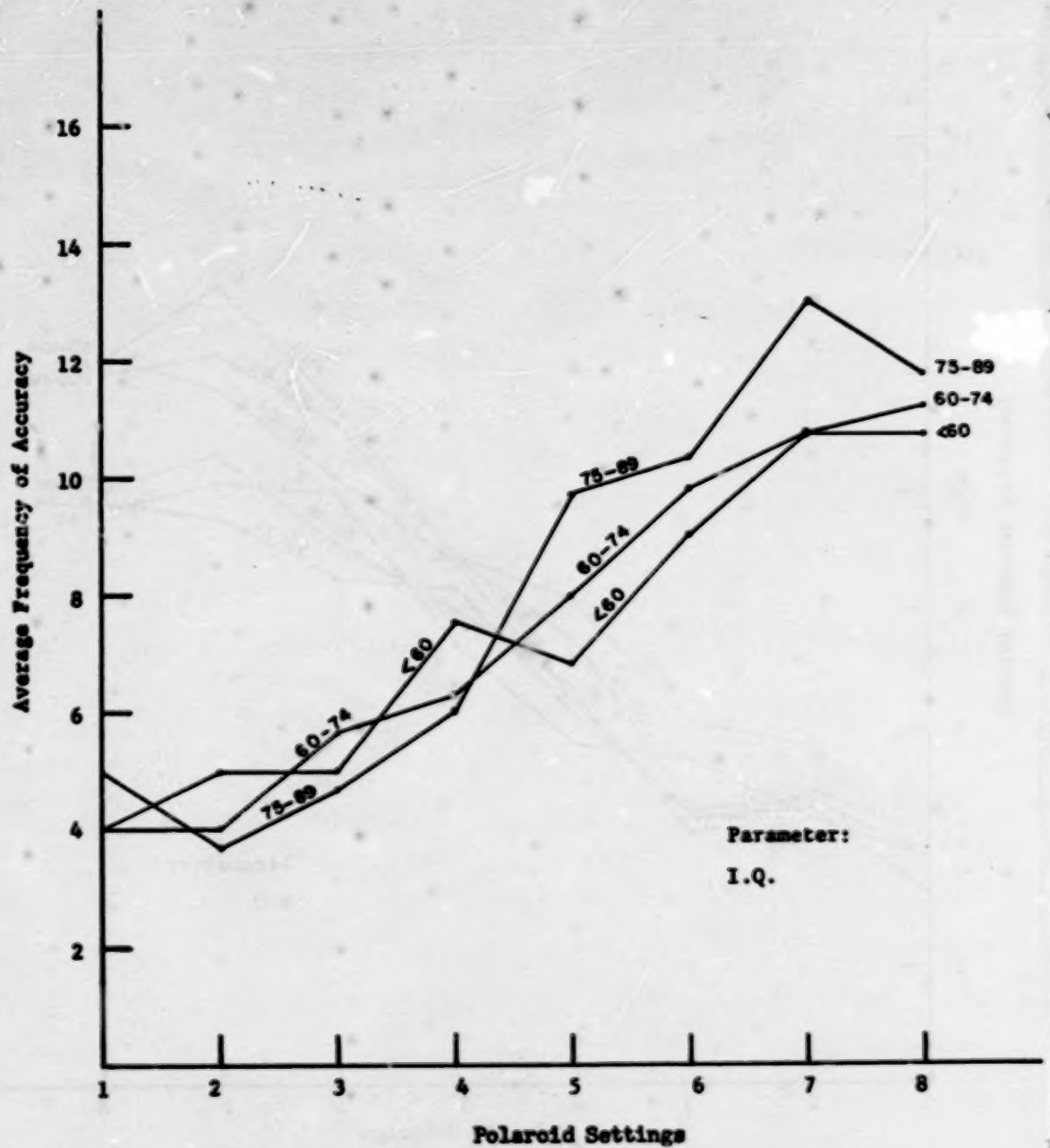


Figure 18.

Accuracy: Absolute-discrimination, institutionalized, by I.Q.

rather clear from these curves. The scores of children in the normal range show less of a depression at Intensity 5 than do scores of children with lower IQ's. Response frequency at the higher intensities seems almost directly related to IQ. This is especially evident in Figure 10, which deals with institutionalized children only, where the curves follow IQ.

The relationships found for these curves differ from those for size-discrimination, and also for the same absolute discrimination involved when the task was zeroing-in. The responses required of the subjects were the same in both cases, that is, to locate the required circle. There are, however, several distinctions between the various tasks, which can now be considered. The zeroing-in task differs from the accuracy task in at least two major ways. First, in the zeroing-in task, the order of stimulus presentations is an ordered one, that is, energies decrease in intensity by means of steps, but in the accuracy task intensities are scrambled. It will, however, be noted that for size discrimination, this produced no marked changes. Secondly, there was a temporal difference. The zeroing-in tasks were of necessity run first, and also for a shorter period. However, this produced no marked changes in the size discrimination tasks. In size discrimination, for retarded children, output in accuracy at Intensity 5 was bracketed around input at that intensity during zeroing-in; for normal children, there was increase in performance. In absolute discrimination, there was response attenuation in most cases.

Consideration of the response processes involved in the accuracy tasks may suggest a possible explanation for these differences. In the accuracy task at least two responses are involved. One is response

occasioned by a difference between the stimuli presented, for example, a dark field, with a lighter area somewhere. The second response involves locating that difference with reference to the coordinates established by the experimenter, for example, the lighter area is up, down, left, or right, with reference to the other areas. In the size discrimination task, the coordinates are always present. Three large circles act as a reference point which can define the fourth circle, the discriminative circle. In the absolute discrimination task, the coordinates depend upon the discriminative circle itself; there are no others.

Turning to the zeroing-in period, the session starts out at maximal intensity, providing reference points at the onset, and providing training in such response during the session. As the intensity is decreased, the locational referents diminish, but apparently, the learned responses continue to be under stimulus control, producing the curves noted. In the psychophysical task which follows, the situation is altered by the addition of new responses and a new stimulus sequence. The disrupting effect upon performance of stimulus alterations has been noted in the literature (e.g., Levin, 1954); interestingly, the size-discrimination task is not disrupted, but the absolute task is. Both tasks have the difference type of response in common, but differ in the locational task involving presentation of coordinates. Conceivably, this is the source of the difference. Further support is lent to this interpretation by consideration of the intensity orders, and asymptotes. The zeroing-in task was characterized by presence of maximal intensities, that is, at the beginning of the sessions. In the accuracy task, there was an occasional high intensity presentation made at different times. It will be recalled from the absolute curves that this intensity (inten-

sity 3) tended not to produce asymptotic responses. In one case (accuracy 14), a high intensity controls the response; in the other case (accuracy task), it does not. In one case, that intensity is preceded by a higher intensity; in the other case, it may not be. These data suggest that variables related to responding in the absence of a controlling stimulus conditions at a prior presentation (such as perseveration of behavior at low intensities, e.g., guessing), may be involved in the group differences obtained under these conditions.

C. Psychophysical Semantic Curves: (a) Size discrimination. Paired with the locational response of the psychophysical session was a Yes-No response, in which Yes was subdivided into categories of 2 and 1. Such Yes responses have been summed, for response (that is, a 2 response and a 1 response are treated as two Yes responses), with age as the parameter in Figures 19, 20, 21; these include curves for normal, DMI, and DMI subjects. It will be noted that no clear ordinal relations can be established either for age or for group. Curves of the normal children tend to follow the classical psychophysical curves, while curves for the DMI children tend to be considerably more erratic. All curves tend to approach the upper asymptote. At the lower intensities, however, differences emerge. The normal subjects tend to approach the zero asymptote, that is, to report not having seen the stimulus at intensities at which they were engaging only in chance performance for the accuracy curves. The mentally retarded children, however, give a considerable number of reports of having seen the stimulus in the location they called out at intensities at which their accurate locations were no better than could be expected by chance. Further, if the curves are superimposed on each other, the curves of the retarded children tend to be as high

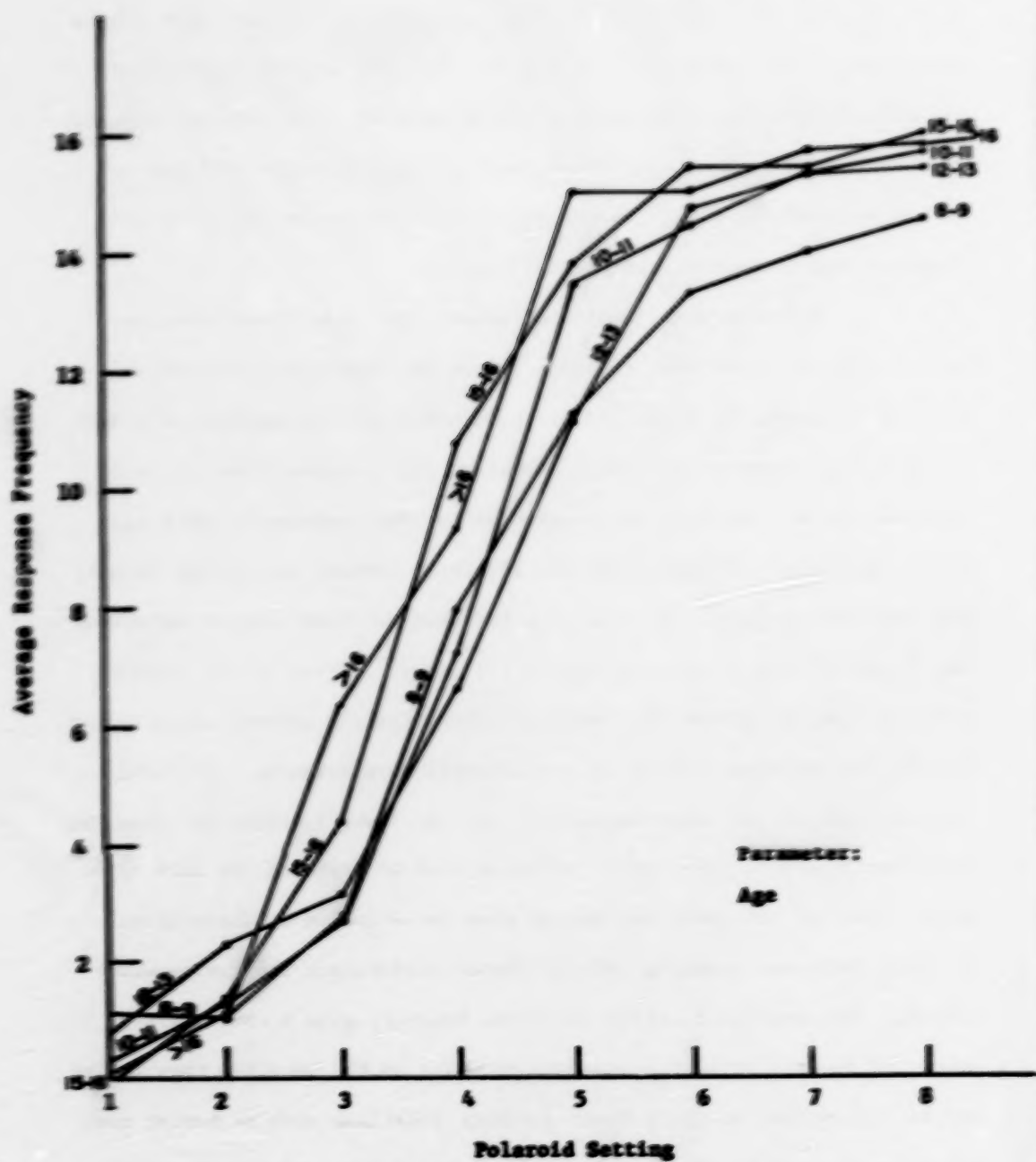


Figure 19.

Yes Responses: Size-discrimination, normals, by age.

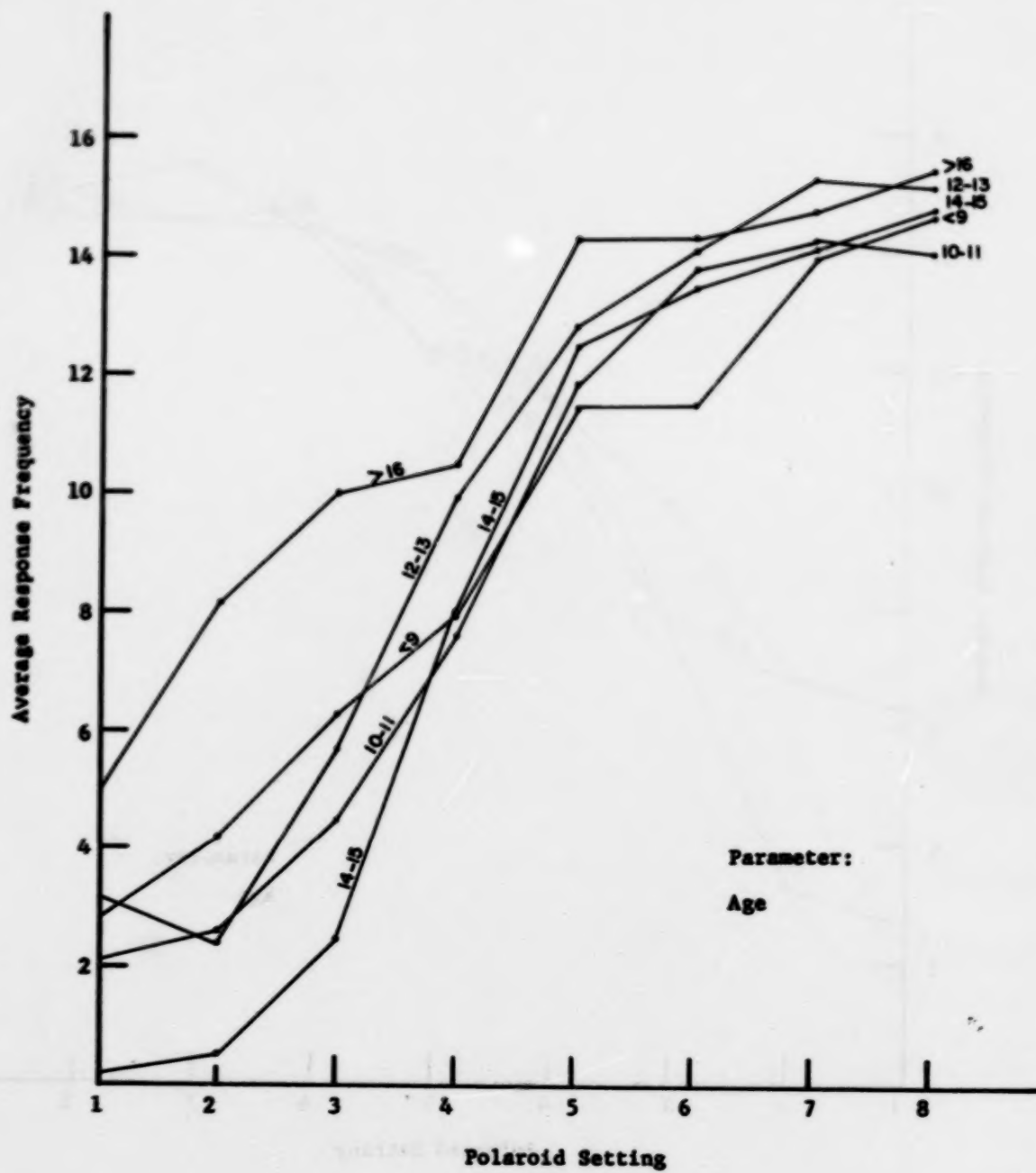


Figure 20.

Yes Responses: Size-discrimination, E.M.H., by age.

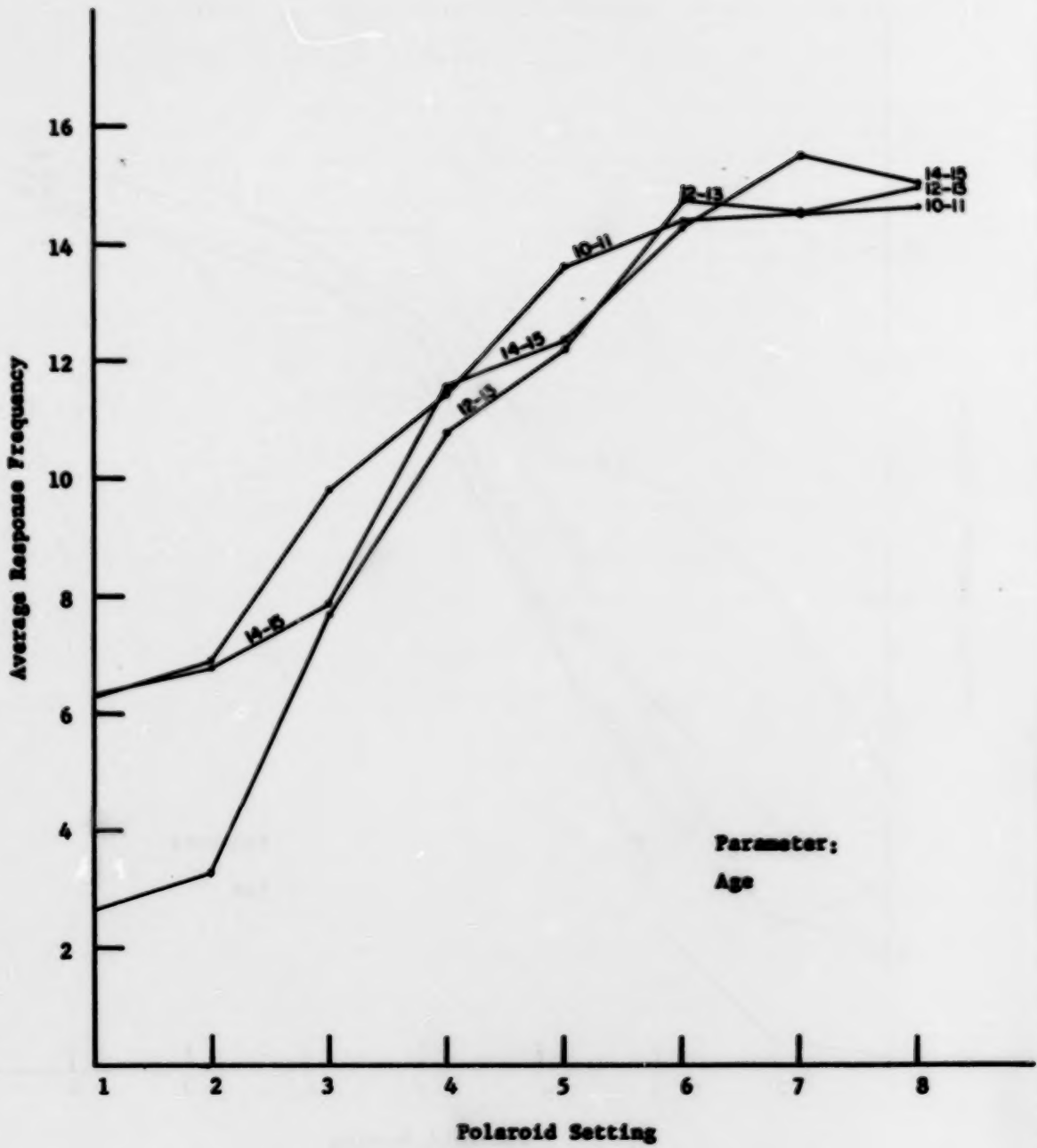


Figure 21.

Yes Responses: Size-discrimination, I.M.H., by age.

as those of the normals, that is, frequency of reports of signal detection is equally high for all groups. It will be recalled that accuracy for all groups was not equally high. Accordingly, the discrepancy between accuracy and report of signal detection is greater for retarded subjects than for normal subjects. Reports of signal detection, with IQ as the parameter, are presented for institutionalized and non-institutionalized subjects in Figures 22 and 23. The relations found in the age curves tend to continue.

(b) Absolute discrimination. Reports of signal detection in the absolute series, with age the parameter, are presented in Figures 24, 25, and 26 for the three groups of this study. What is most striking about these curves is the large number of reports of signal detection given by the institutionalized subjects at the low intensities. Comparison with corresponding curves for size discrimination reveals interesting differences. In terms of accuracy, location of the absolute figure was not as frequent for all groups as was location of the smaller figure in size discrimination. Indeed, the number of reports by normal children, of having detected the signal in the position trial only is lower for absolute discrimination than for size, which is reasonable. For the EMI groups, this tendency continues, but there is considerable overlap, mainly at intensities 1-4. For the IMI groups, reports of signal detection overlap at the higher intensities, but diverge at the lower, with such reports more frequent for absolute than for size discrimination. Replotting with IQ the parameter, provides no additional information as can be seen from Figures 27 and 28.

D. Total Responses: (a) Size discrimination. Another way of presenting the same data is in terms of total number of responses for

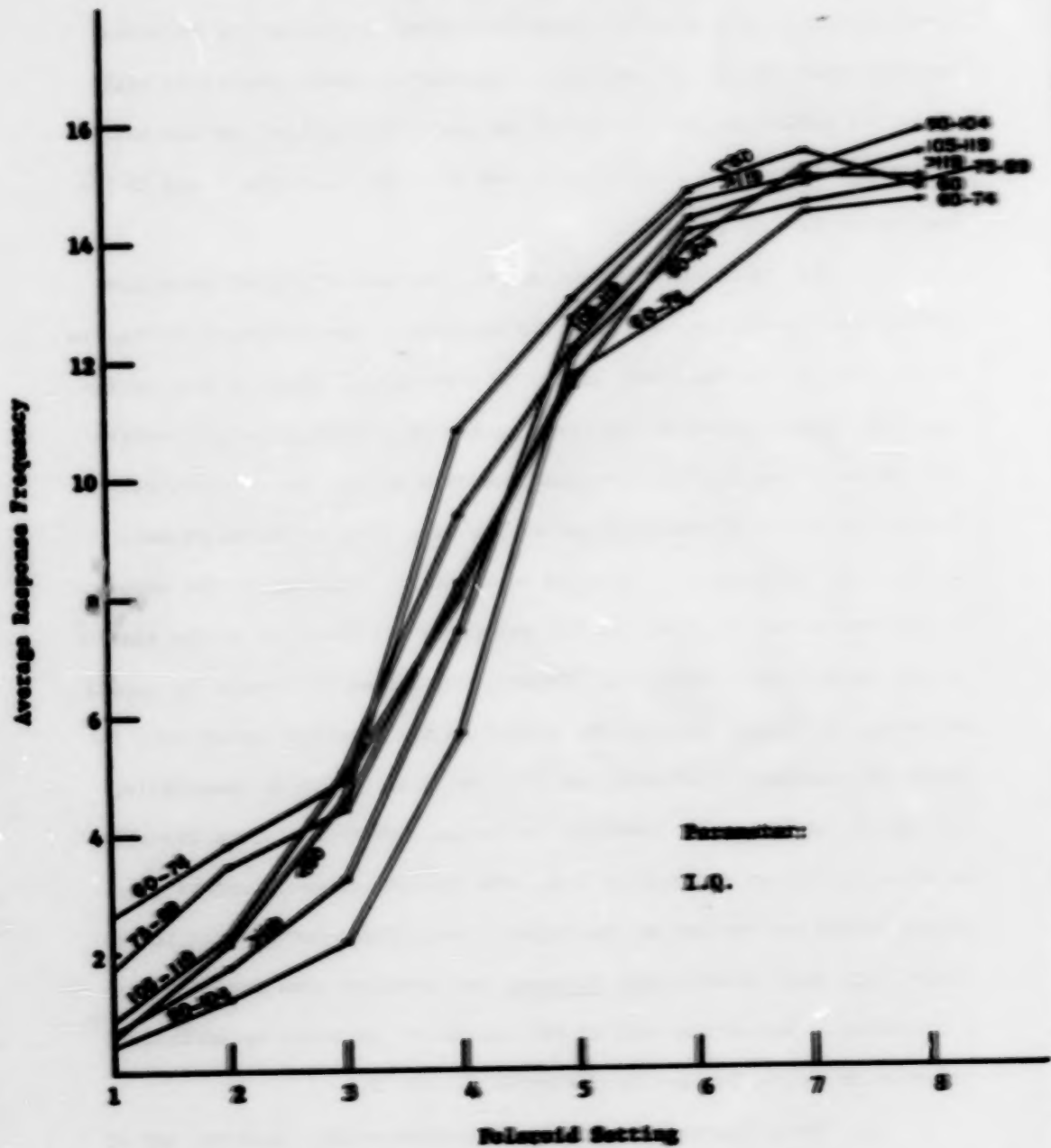


Figure 22.

Yes Response: Stim-discrimination, noninstitutionalized, by I.Q.

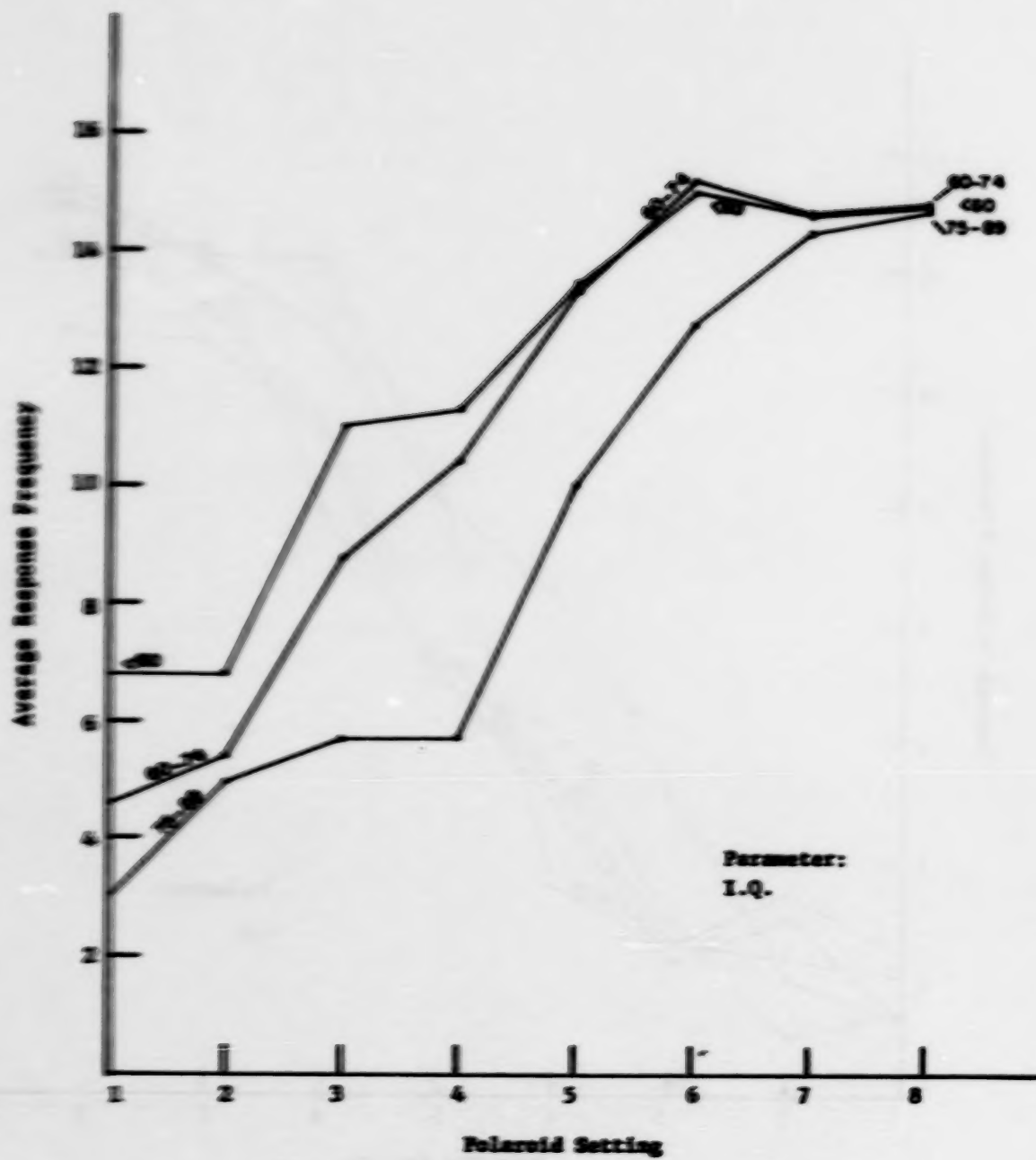


Figure 23.

The Response: Size-discrimination, institutionalized, by I.Q.

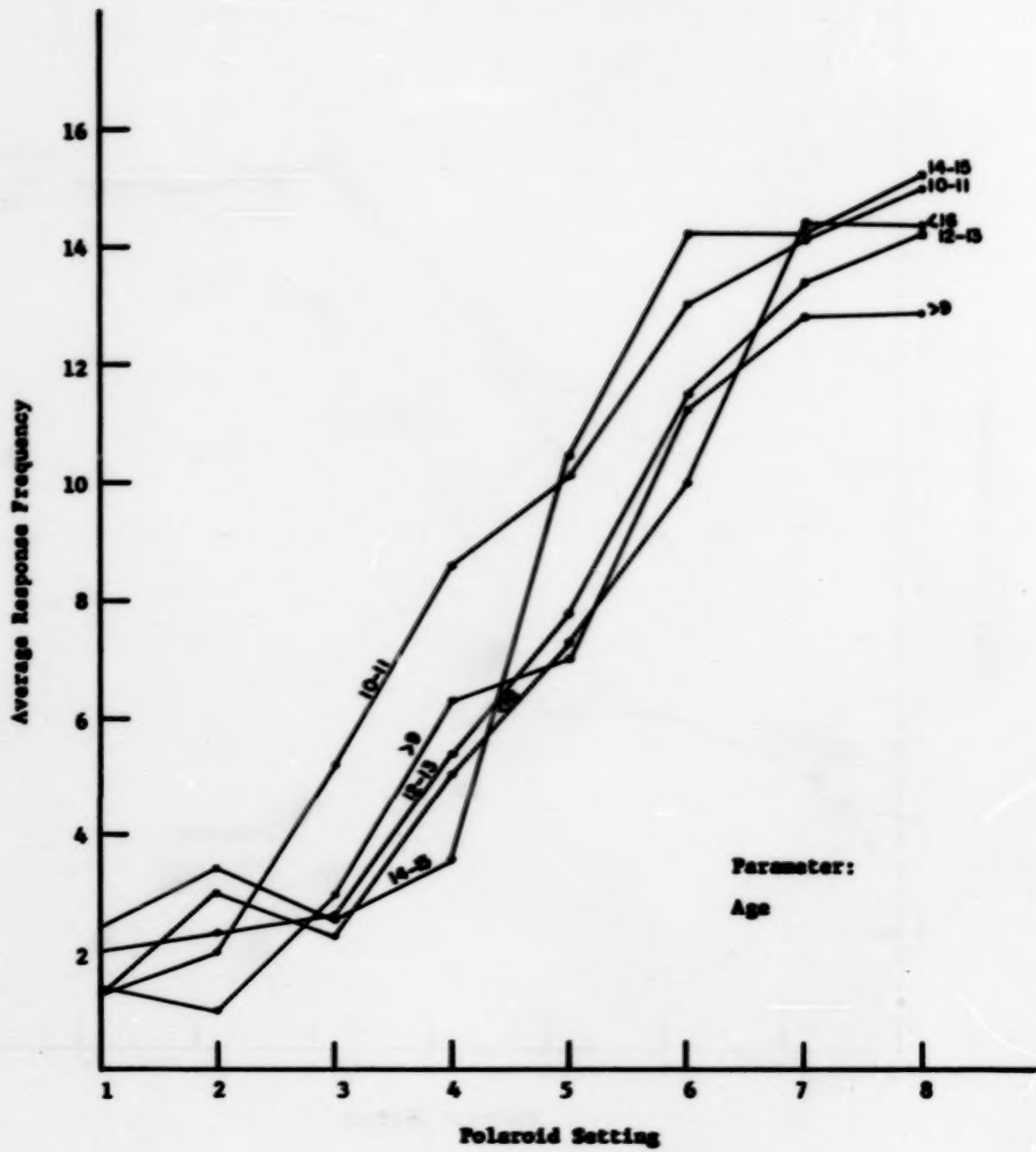


Figure 24.

Yes Responses: Absolute-discrimination, normals by age.

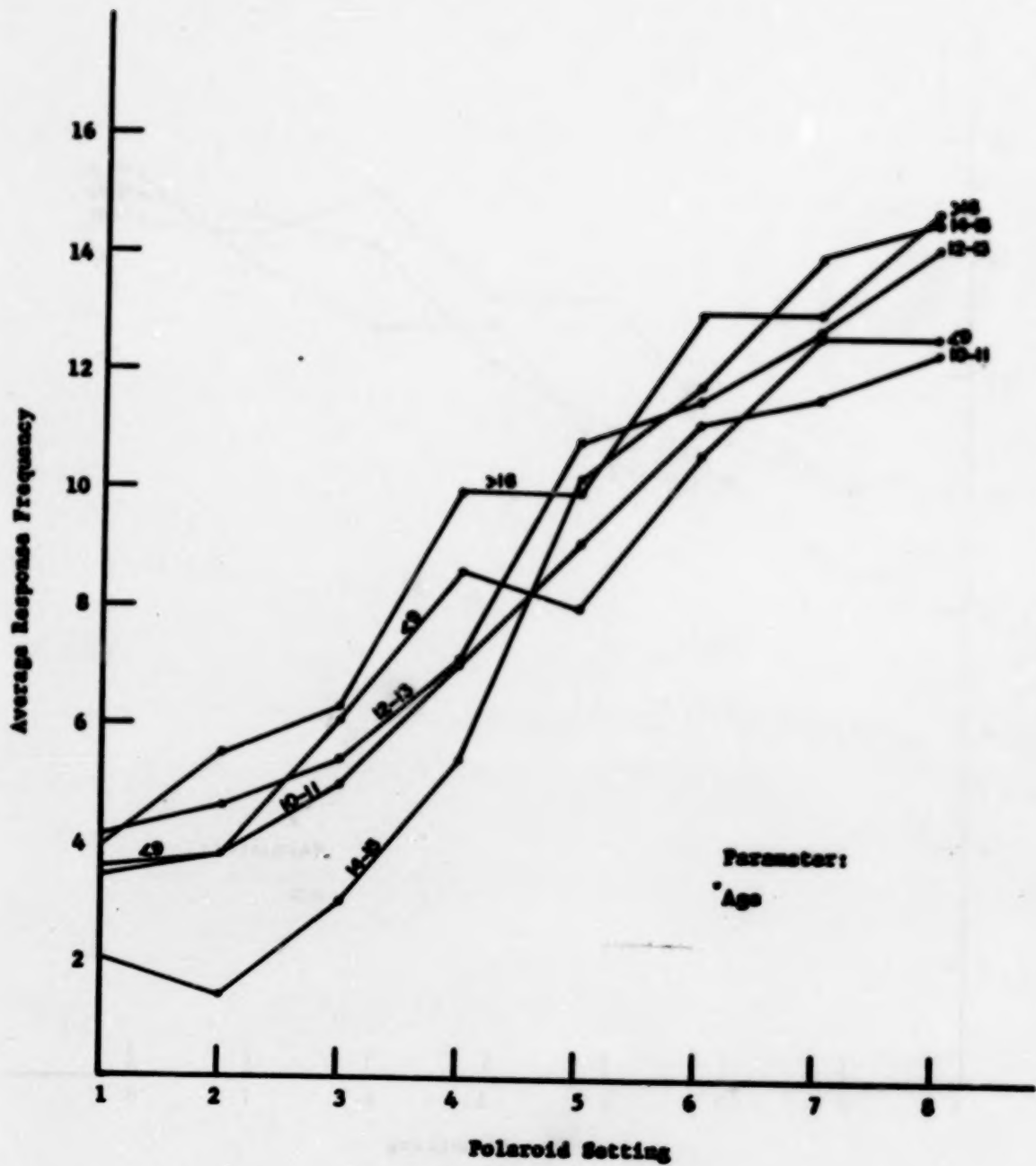


Figure 25.

Yes Responses: Absolute-discrimination, E.M.N., by age.

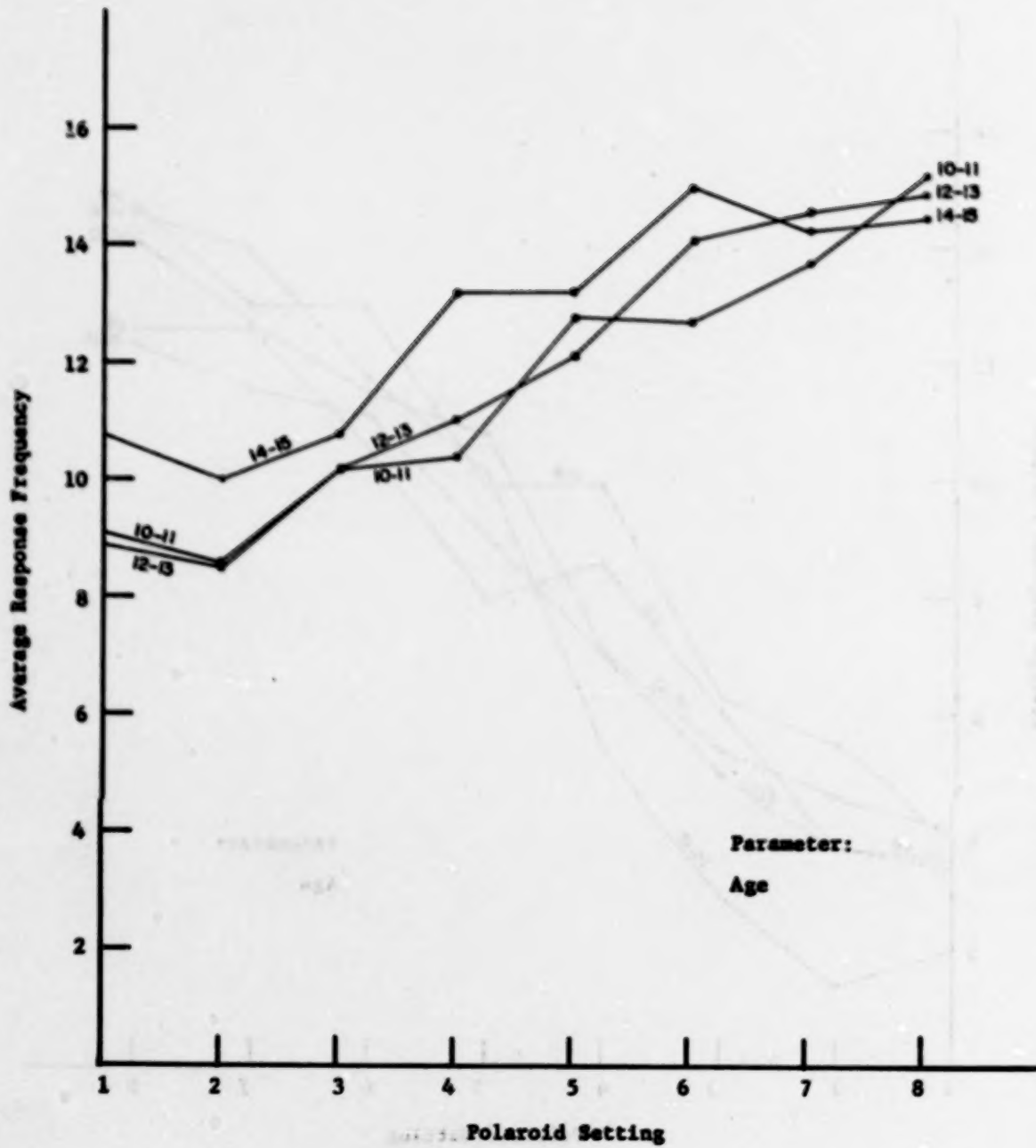


Figure 26.

Yes Responses: Absolute-discrimination, I.M.H., by age.

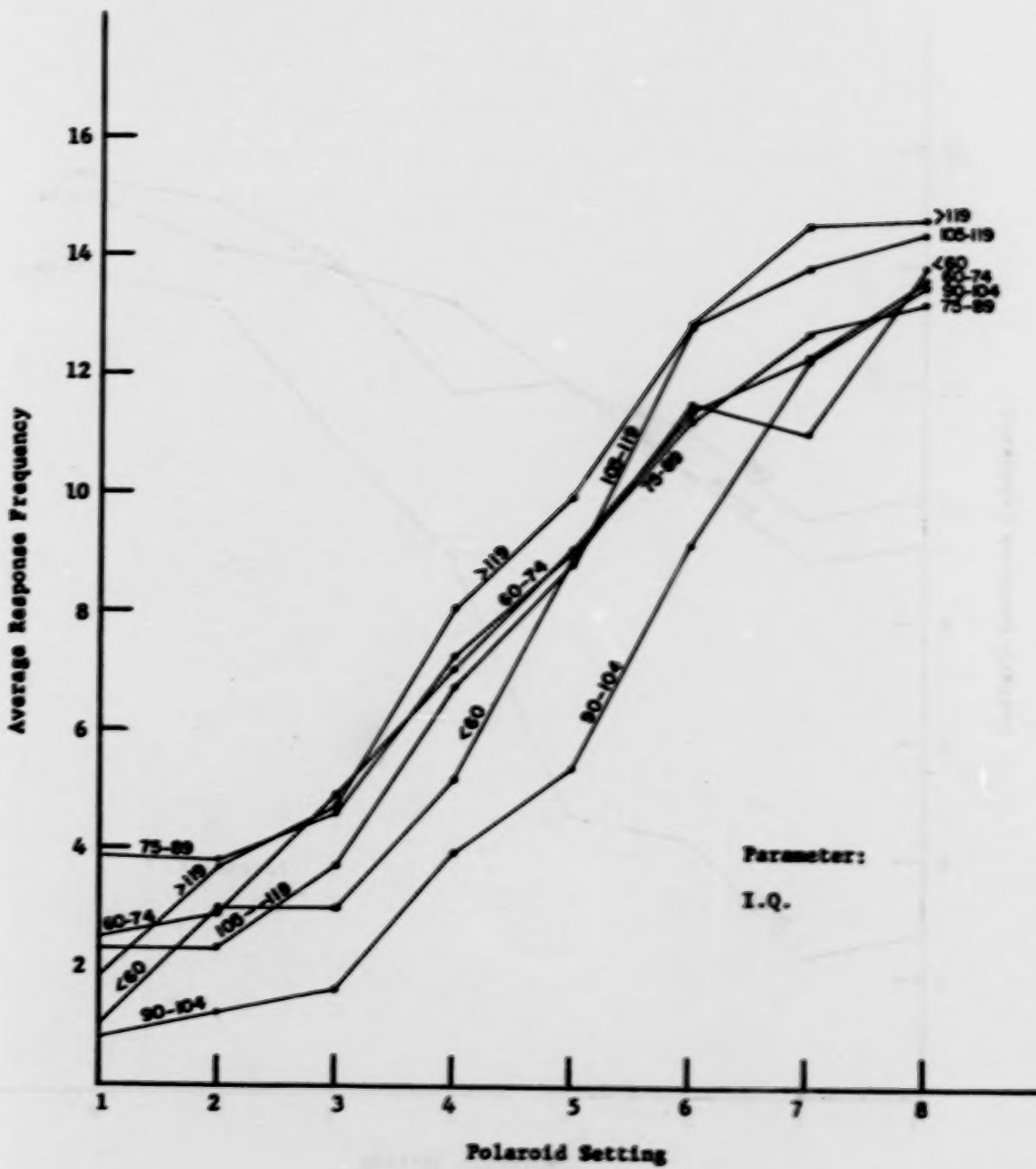


Figure 27.

Yes Responses: Absolute-discrimination, noninstitutionalized, by I.Q.

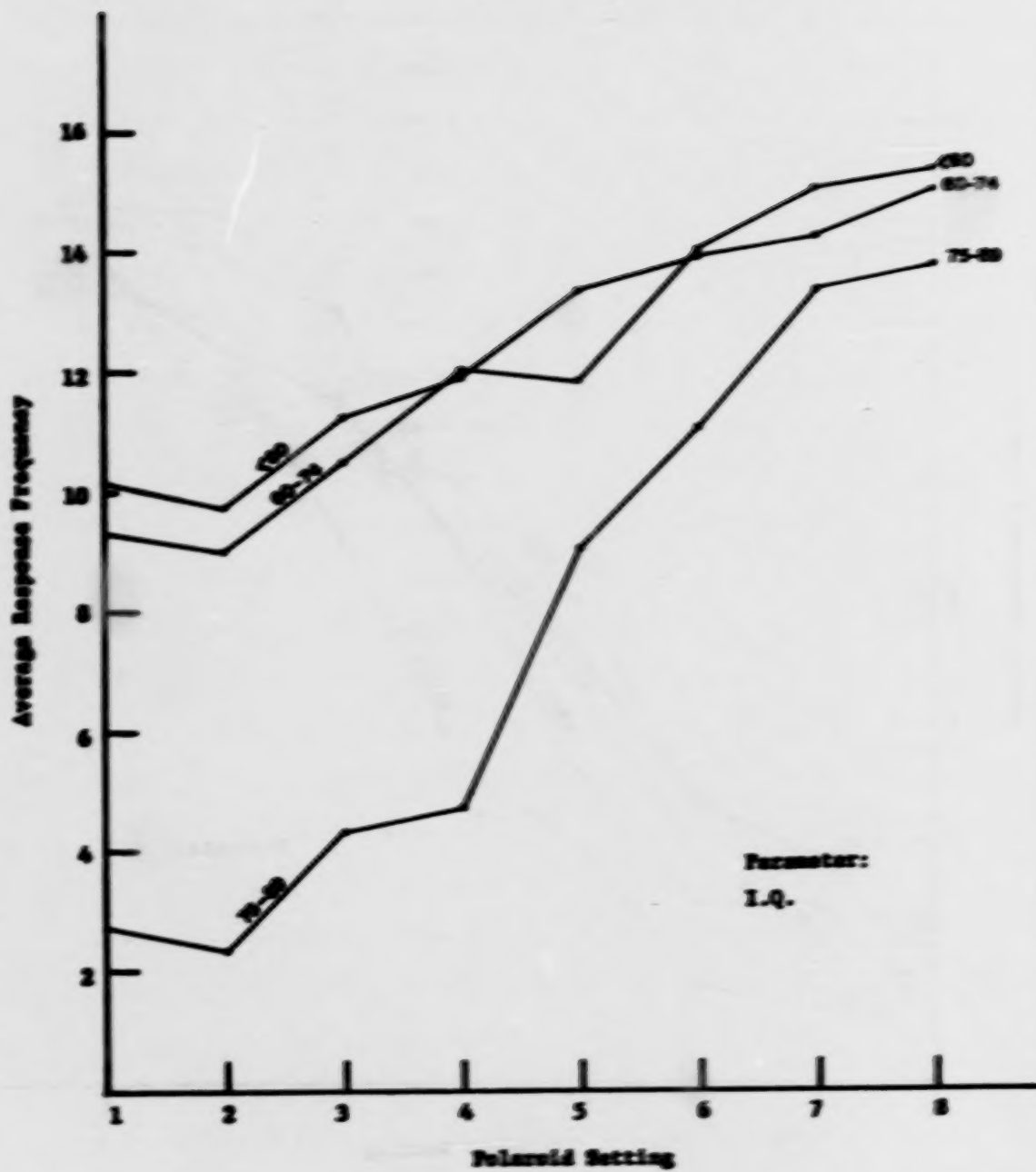


Figure 28.

Yes Responses: Absolute-discrimination, uninstitutionalized, by I.Q.

each session. This procedure allows for parsimonious comparison, for a given variable, of the various curves involved. For size discrimination, such curves are presented in Figure 29, with the parameter being age. There were 128 presentations in this task, with chance for accuracy being 32. It will be noted that accuracy dispersion tends to be independent of age, and that more accurate responses are given by normal children at every age level than by retarded children. These responses, it will be recalled, deal with dispersion around a mean obtained in the learning-in period. The responses labeled Yes in the psychophysical curves presented in the preceding figures are represented in this figure by the curves labeled 2+1. The relationship of these curves to the accuracy curves reiterates the differences found in the psychophysical curves. Normal subjects tend to report detecting the signal less often than they are accurate; the EMH subjects tend to report signal detection as often as normal subjects, but since their accuracy is lowered, the accuracy and detection curves overlap. The institutionalized subjects are far more generous with reports of signal detection.

Of special interest is the breakdown of Yes responses into their component 2 and 1 responses. The number of 2 responses given at ages 8-9 is similar for normal and retarded subjects. Thereafter, there is a decline with age in the use of such responses for the normal subjects. For the EMH groups, the number of such responses remains at the same level; the EMH curves can be considered as being similar. With regard to the use of the response 1, this tends to start at the same low level for normal and retarded subjects, but tends to increase for the normal subjects as a function of age. For retarded subjects, use of this response remains at the same low level, rising only at age 16. The overwhelming proportion of Yes responses for retarded subjects consisted

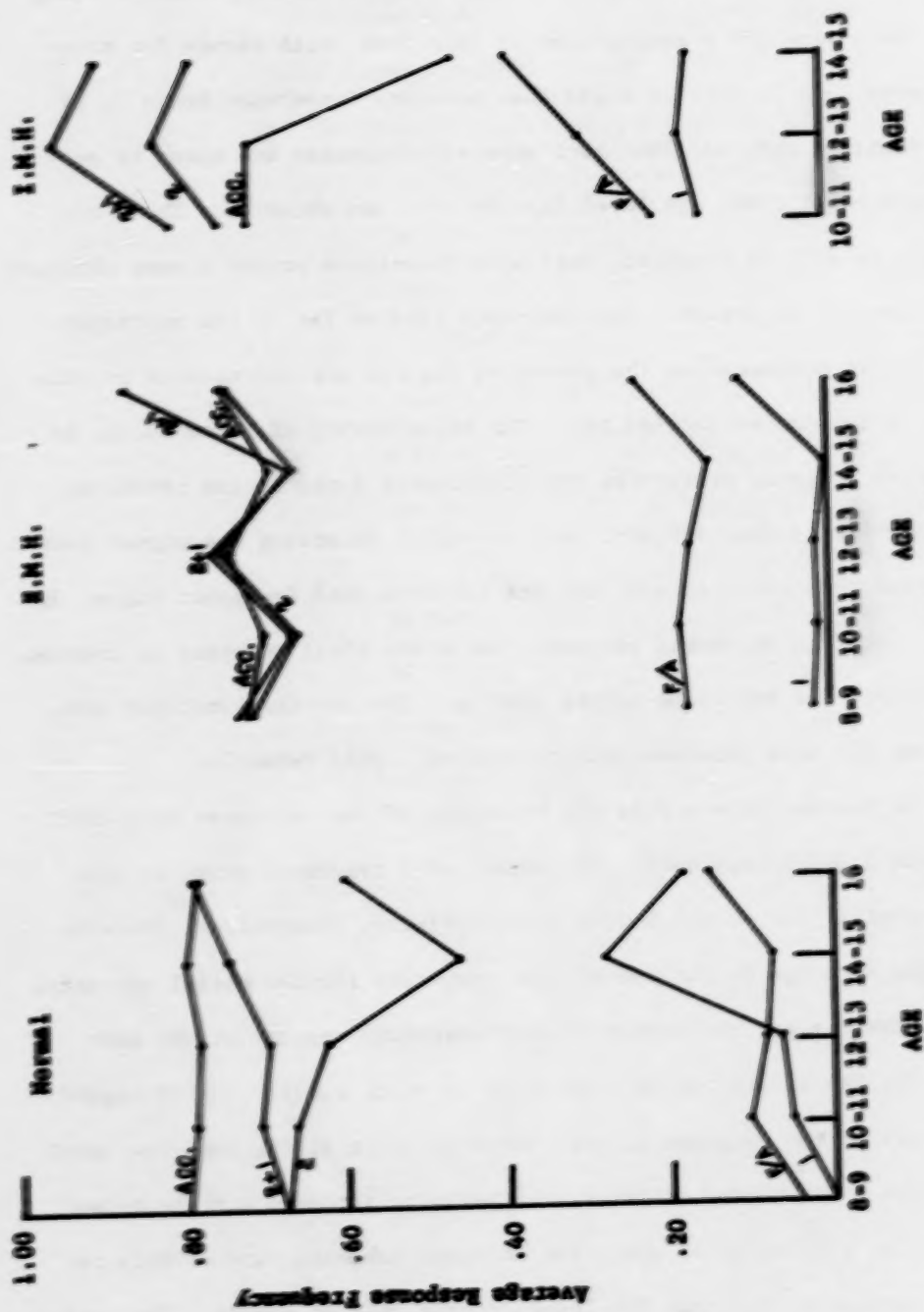


Figure 29.

Comparison of indicators, size-discrimination, all groups, by age.

of 2's. The F/A curves represent an analogy to the false alarm rate used in the decision theory of signal detection. In decision theory, this represents reports of signal-detection when none was present. In the tasks of this experiment, a signal was always present; false alarm is used to refer to reports of signal-detection in a location in which the signal was absent, that is, report of Yes accompanied by false location. It will be noted that this rate is higher for retarded than for normal subjects. This is not accompanied by increased report of signal detection for EMH subjects (as opposed to normals). For normal subjects, a slight positive relation with age is accompanied by similar increase in signal detection. The nature of signal detection responses, however, shifts from exclusive use of 2 at age 8, to greater increase of 1 for normal subjects.

The same data plotted as a function of IQ are presented in Figure 30. Accuracy tends to increase with IQ, as does the use of 1, for non-institutionalized children. The use of 2 tends to drop for all children; for the non-institutionalized children, false alarm rate tends also to drop with increase in IQ. The non-institutionalized curve represents EMH children at the lower levels, and normal children at the higher levels.

(b) Absolute discrimination. Data for absolute discrimination, with age the variable are presented in Figure 31, which depicts relations similar to those found for size discrimination. Accuracy tends to increase with age, with the normal children more accurate than the retarded children. There is a sharp decline in the use of 2 responses by normal children as a function of age, and a similar increase in number of 1 responses. For the matched EMH children, this is not

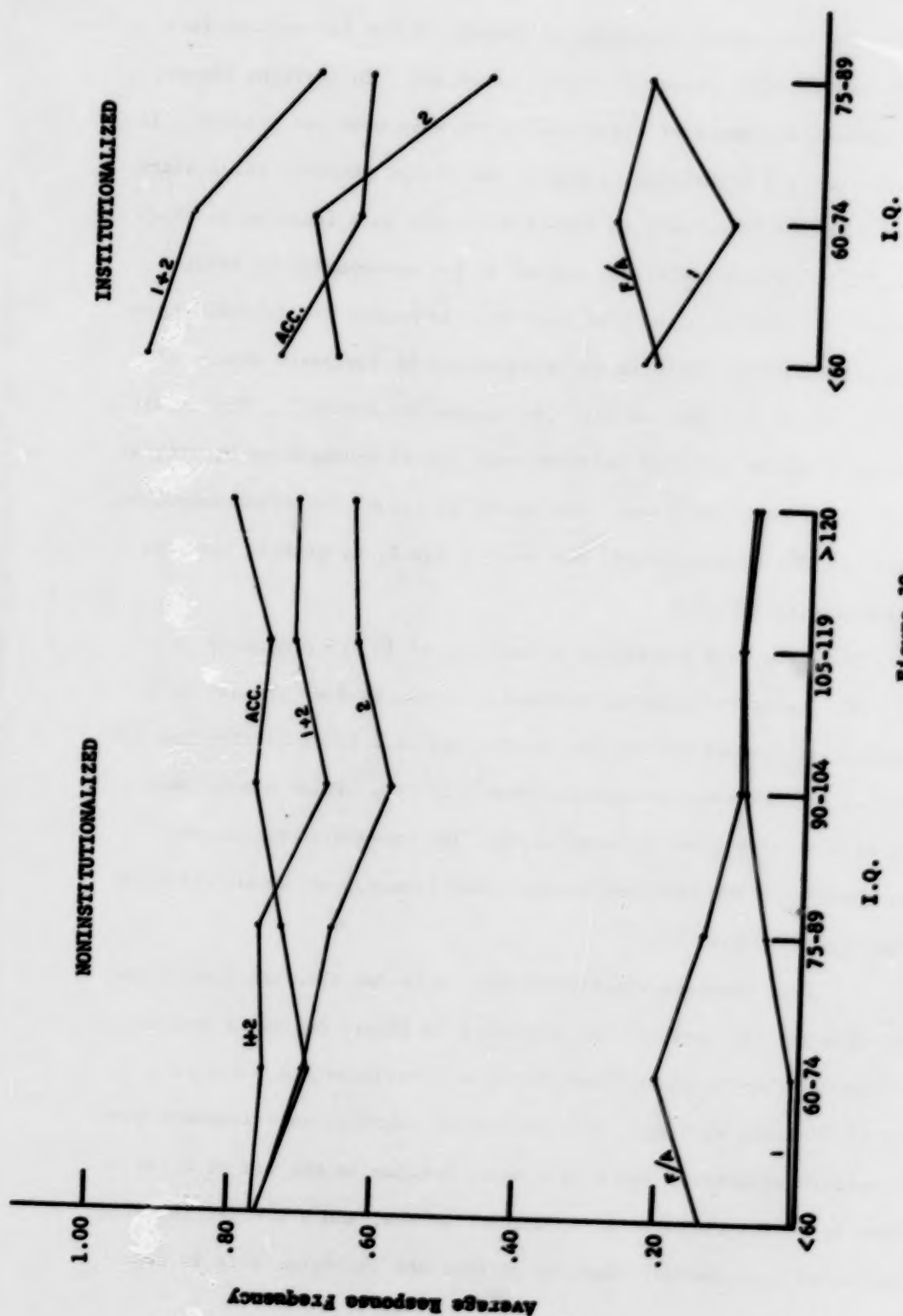


Figure 30.
Comparison of indicators, size-discrimination, all groups, by I.Q.

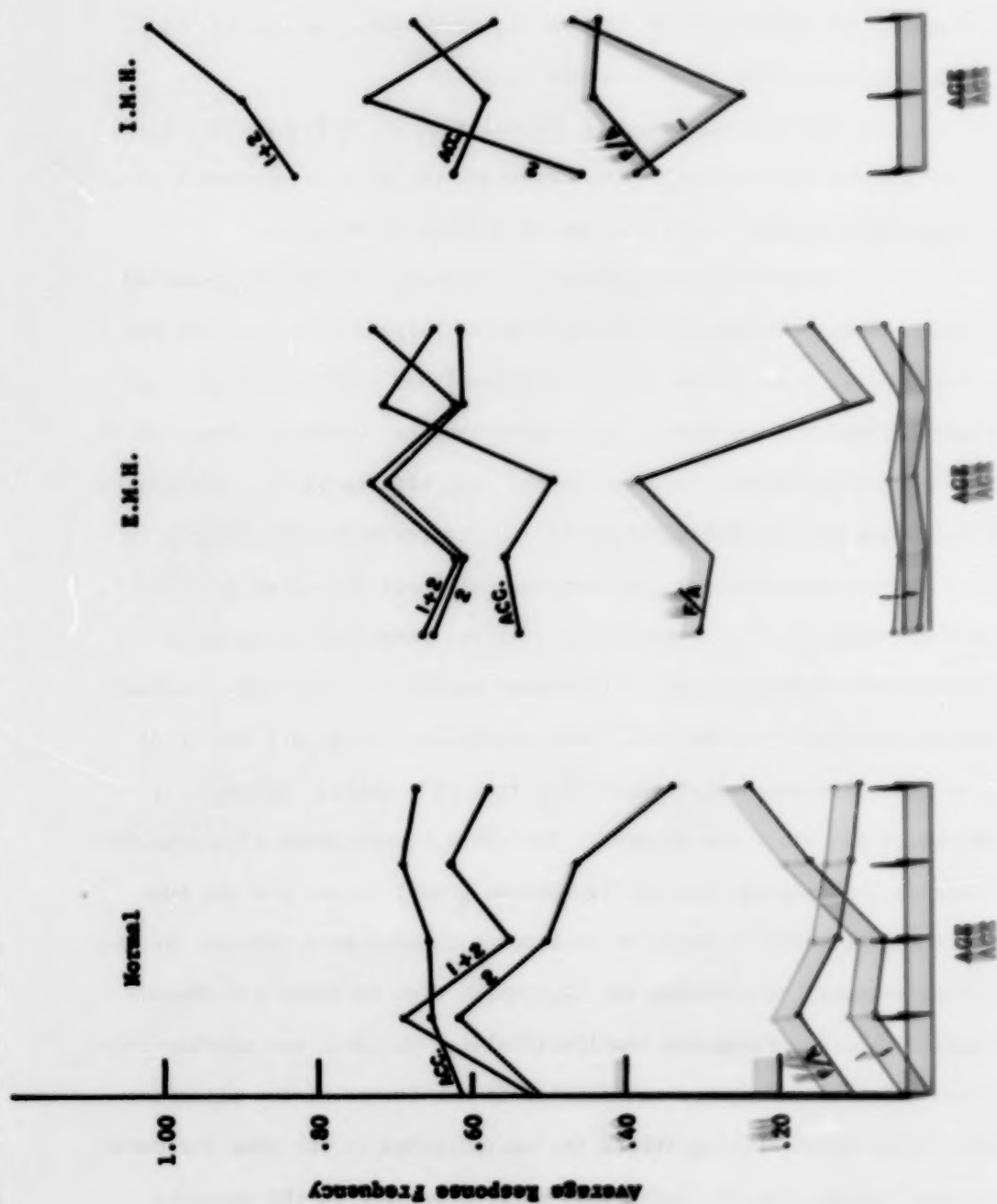


Figure 31.

Comparison of indicators, absolute-discrimination, all groups, by age.

the case. Whereas, at age 11, the response 2 accounts for almost all Yes responses in both groups, for normal children aged 14-15, this accounts for approximately 6% of Yes responses; for similar RMH children, 2 accounts for approximately 100% of Yes responses. At age 16, these percentages are about 30 as compared to 85.

The data are replotted as functions of IQ in Figure 22. Again, there is a steady rise in both accuracy and use of the response 1 as a function of increase in IQ; the use of 2 tends to diminish.

E. Effects of Manipulandum on Response. It will be recalled that the institutionalized children had two buttons to press, one for 2 and one for 1, while the non-institutionalized children pressed one button either once or twice. The lights attached to the buttons lit up in a similar manner for both groups. The effects of the differences in manipulandum can probably best be seen in terms of relationship to IQ. The relationships for the responses of 2 are presented in Table 4, and the relations for the responses of 1 are presented in Table 5. Differential effects of the extra button versus the extra tap, can not be distinguished from Table 4. Both groups seem to give a number of responses which are indistinguishable from this table. In Table 5, however, differences are evident. The three button group gives considerably more 1 responses than the two-button group. Since for the two-button groups there seems to be an orderly relationship between the use of this category of response and IQ, (which also is found for chronological age), and since the institutionalized children and non-institutionalized retarded groups are similar in the forced choice situation and in the variac setting (since the manipulandum is the same for both), it would appear that the difference is attributable to the separate

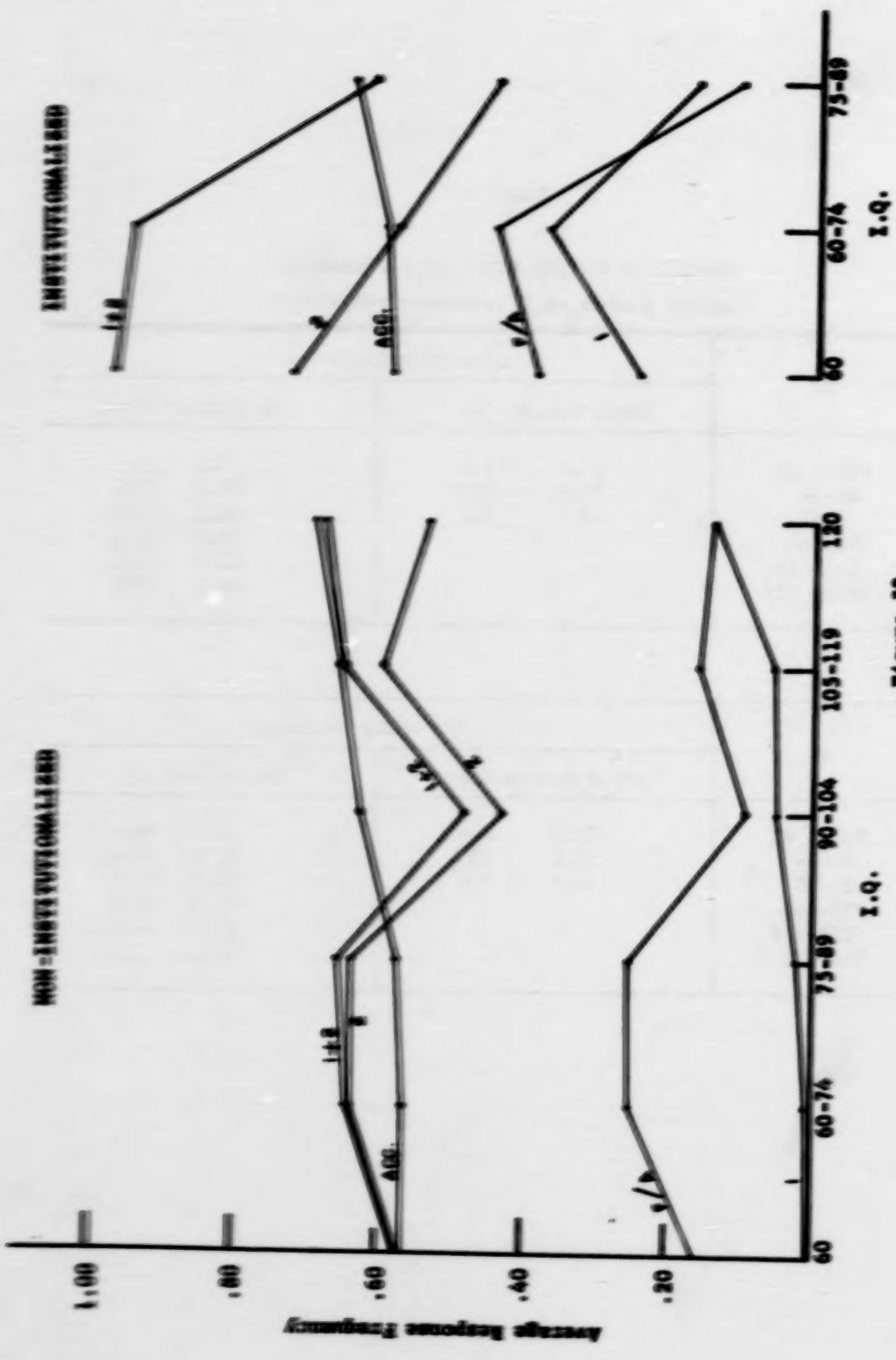


Figure 32.

Comparisons of indicators, absolute-discrimination, all groups, by I.Q.

TABLE 4

EFFECTS OF MANIPULANDUM ON 2 RESPONSES
Average number of 2 responses per child.

IQ	Size Discrimination	
	Three Button (N)	Two Button (N)
Below 60	67.7 (7)	75.4 (5)
60-74	71.7 (23)	69.5 (24)
75-89	46.7 (4)	66.2 (17)
90-104		58.8 (15)
105-119		63.2 (15)
Above 119		64.6 (14)

IQ	Absolute Discrimination	
	Three Button (N)	Two Button (N)
Below 60	72.5 (6)	57.0 (4)
60-74	57.6 (19)	63.9 (20)
75-89	44.0 (3)	63.5 (17)
90-104		47.9 (14)
105-119		64.9 (14)
Above 119		65.2 (13)

TABLE 5

EFFECTS OF MANIPULANDUM ON 1 RESPONSES
Average number of 2 responses per child.

IQ	Size Discrimination	
	Three Button (N)	Two Button (N)
Below 60	24.7 (7)	0.8 (5)
60-74	17.2 (23)	1.0 (24)
75-89	24.3 (4)	5.1 (17)
90-104		3.4 (15)
105-119		9.2 (15)
Above 119		7.8 (14)

IQ	Absolute Discrimination	
	Three Button (N)	Two Button (N)
Below 60	24.3 (6)	0.3 (4)
60-74	37.4 (19)	1.0 (20)
75-89	16.7 (3)	2.5 (17)
90-104		9.4 (14)
105-119		16.1 (14)
Above 119		14.4 (13)

button. Apparently, given an extra button to push, mentally retarded children at least, will utilize it more often. This increase in the use of 1 responses given the extra button, would seem to account for the heightened curves of the institutionalized children on the summated Yes responses, since their 2 responses do not differ from the non-institutionalized children. This would also account for the increased number of false alarms by the institutionalized children, but does not account for the increase in false alarms by the non-institutionalized children, nor would it account for the differences noted between non-institutionalized mentally retarded children and normal children.

F. Time taken to do Task. A crucial difference between normal children and mentally retarded children should be noted at this point. For normal children, each psychophysical task took about one hour, giving the children two hours in the booth. The time figures varied with the number of variac presentations needed, but there were very few repetitions necessary, and it can be generally stated that the amount of time taken by the normal children was a direct function of the number of stimulus presentations on the score sheet. With regard to the retarded children, this was not generally the case. Only half of the children run in both groups completed the task in the amount of time which could have been predicted from the score sheet. A single test often took a complete morning or complete afternoon, or so much longer that the subjects could not be run. These subjects required constant prompting to respond from the experimenter. When the experimenter left the subject to attend to the controls, response often was not emitted. This would necessitate a prompting, a response, a return to the controls, and a repetition. When responses were obtained, however, they followed the

patterns of response obtained without such prompting.

G. Summary, Psychophysical Tasks. The major results obtained in the psychophysical series run individually for each subject were the following:

1. Stimulus energy required for accurate location. For both size and absolute discrimination, such location may be a function of chronological age, older children requiring lesser voltages for accurate location than younger children. These functions were independent of IQ, children of differing IQ's, but of the same age, scoring similarly in this task. Such change with age may be a developmental function.

2. Accuracy of forced-location around mean. With means equalized for the various subjects, normal children tended to give more accurate responses than retarded children for both size and absolute discrimination, especially at settings where energy levels were raised above respective means. This was especially noted in absolute discrimination, and the lower scores of retarded children seemed attributable to absence of reference points in the absolute discrimination task, and to variables related to decreased perseveration of learned locational responses in the absence of controlling stimulus conditions. Retarded children tended to reach upper asymptotes less often than normals, and absolute curves tended to reach upper asymptotes less often than size curves. It was suggested that this greater dispersal, around means obtained during the zeroing-in periods and greater variability, might be related to responses not under stimulus control, with the result that range of intensities used did not bracket upper levels of response.

3. Report of signal detection. Normal and mentally retarded children tended at lower age levels to make almost exclusive use of the

definite 2 response in reporting signal detection. Use of such responses dropped as a function of age for normal subjects, with the more noncommittal 1 response increasing as a function of age. For retarded children, however, use of the 2 response tended to continue throughout almost all age groups at the high level found in younger children. Use of these responses was also related to IQ, with higher IQ children tending to use less 2 and more 1 responses than children of lower IQ.

4. False alarm. Report of signal detection in locations which did not contain the signal was a function of age, IQ, group, and task. Normal children tended to give less false alarms than retarded children.

Discussion of the implications of these results will be deferred to a later section.

Other Tasks. All tasks except the psychophysical tasks which were conducted in booths designed for the purpose, were given in a special room set apart from the psychophysical room. This section of the report will be devoted to the other tasks. These consist of reaction time, size constancy, and the two illusions used: Muller-Lyer Illusion and Titchener Circle Illusion.

A. Reaction Time. The reaction time apparatus was an adaptation of the Stoelting apparatus. This consists of a wooden board facing the subject on which are two white plastic chips, four inches apart. Behind one is a red light and behind the other a white light. A buzzer also is part of the apparatus. In the original apparatus, measures are taken of the reaction time of the subject when any of these three stimuli go on. In the modification, two microswitches were used. These were 6-1/4 inches apart. The subject was instructed to place his finger

on one button, and wait for the signal, which could either be a red light, a white light, or a buzzer sound. Immediately upon the presentation of the signal, he was to turn it off by pressing the other microswitch with the same finger. The following two measures of reaction time were taken:

(a) *Lift Time.* This constituted the interval between the onset of the signal and the opening of a microswitch when the subject lifted his finger.

(b) *Traverse Time.* This constituted the amount of time which elapsed between the opening of the microswitch just noted (finger lift) to the moment when the subject shut off the signal by pressing the other button.

This procedure separated the reaction time to the stimulus from the traverse time to shut it off.

1. *Procedure Utilized.* Immediately after the training period, eight presentations of the buzzer were made. These were followed by eight presentations of the white light, and then eight presentations of the red light. After these three series, a randomized series was introduced in which the following sequence of signals was presented.

1. White	2. Buzzer	3. Red
4. Buzzer	5. White	6. Red
7. White	8. Red	9. Red
10. Buzzer	11. Buzzer	12. White
13. Buzzer	14. Red	15. Buzzer
16. White	17. Red	18. Buzzer
19. White	20. Buzzer	21. Red
22. Buzzer	23. Red	24. White

2. *Results.* (a) *Reaction time and IQ.* The relationship between IQ and reaction time is presented in Figures 33, 34, and 35 for each of the three stimuli used. It will be noted that throughout

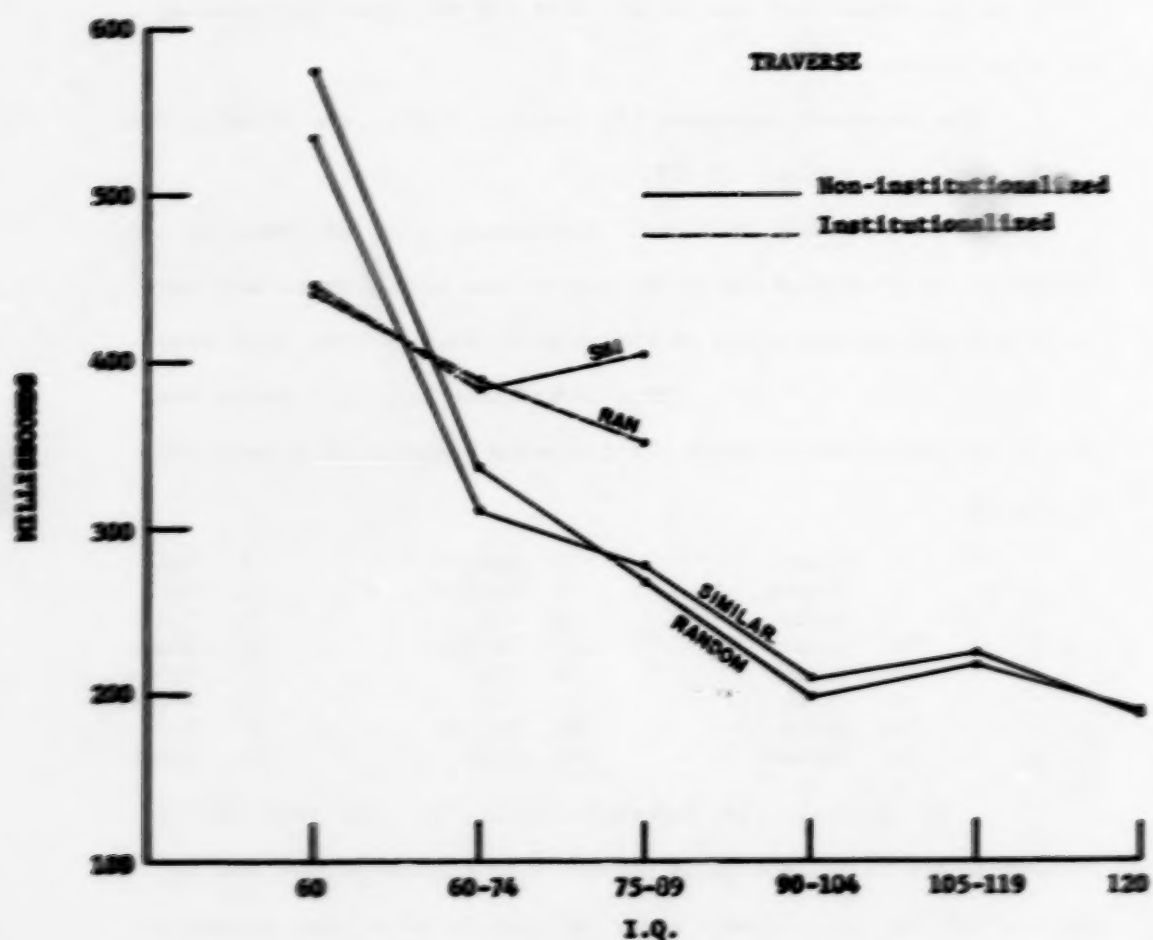
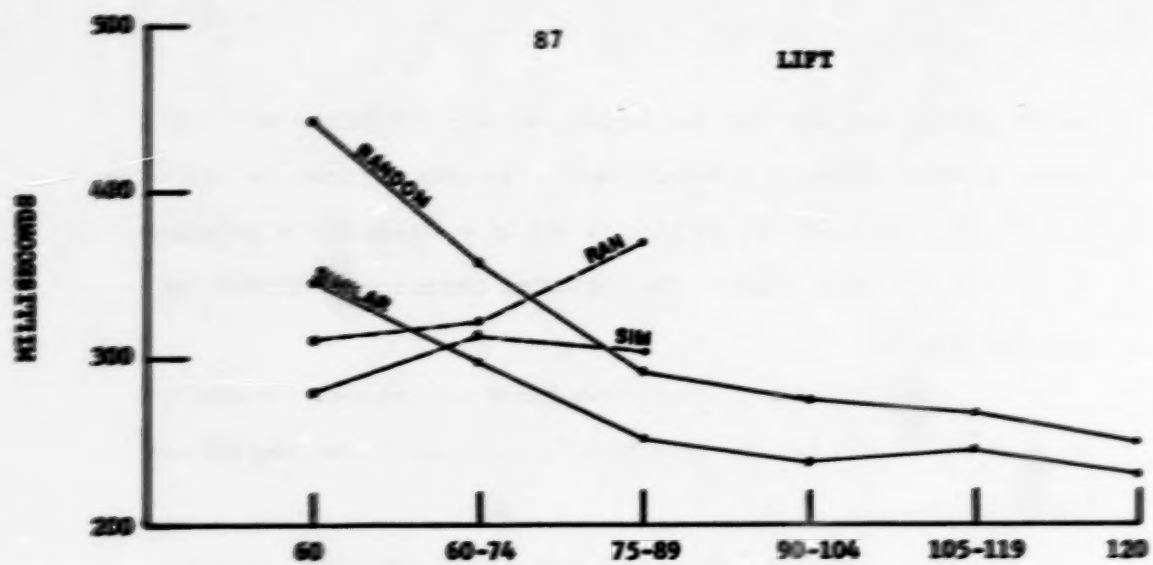


Figure 33.
Reaction time: Rad, by I.Q.

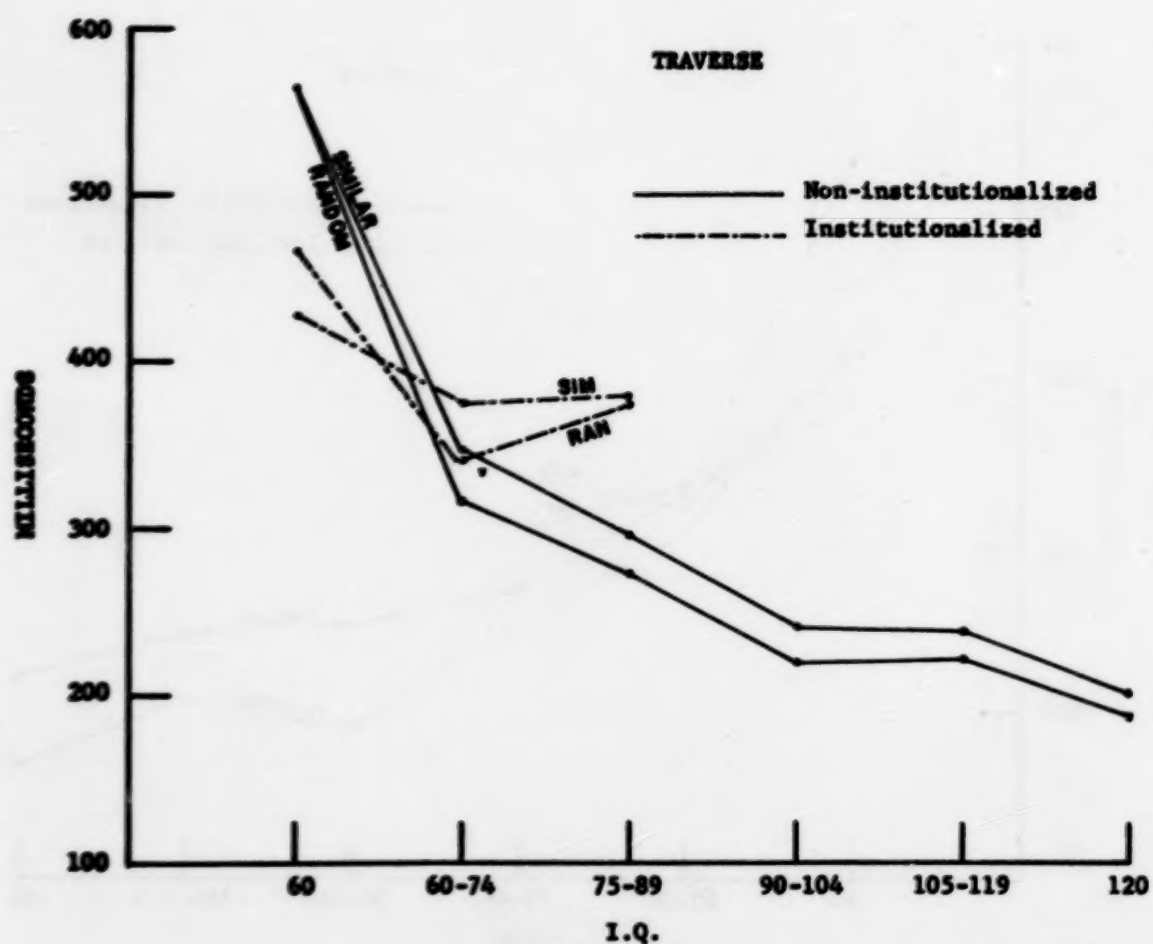
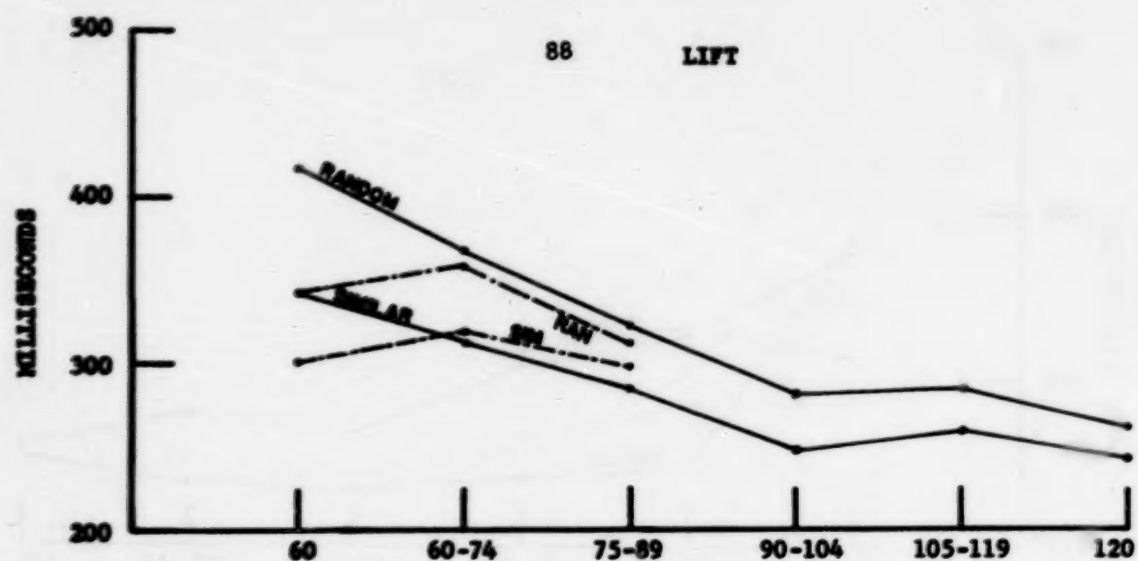


Figure 34.

Reaction time: White, by I.Q.

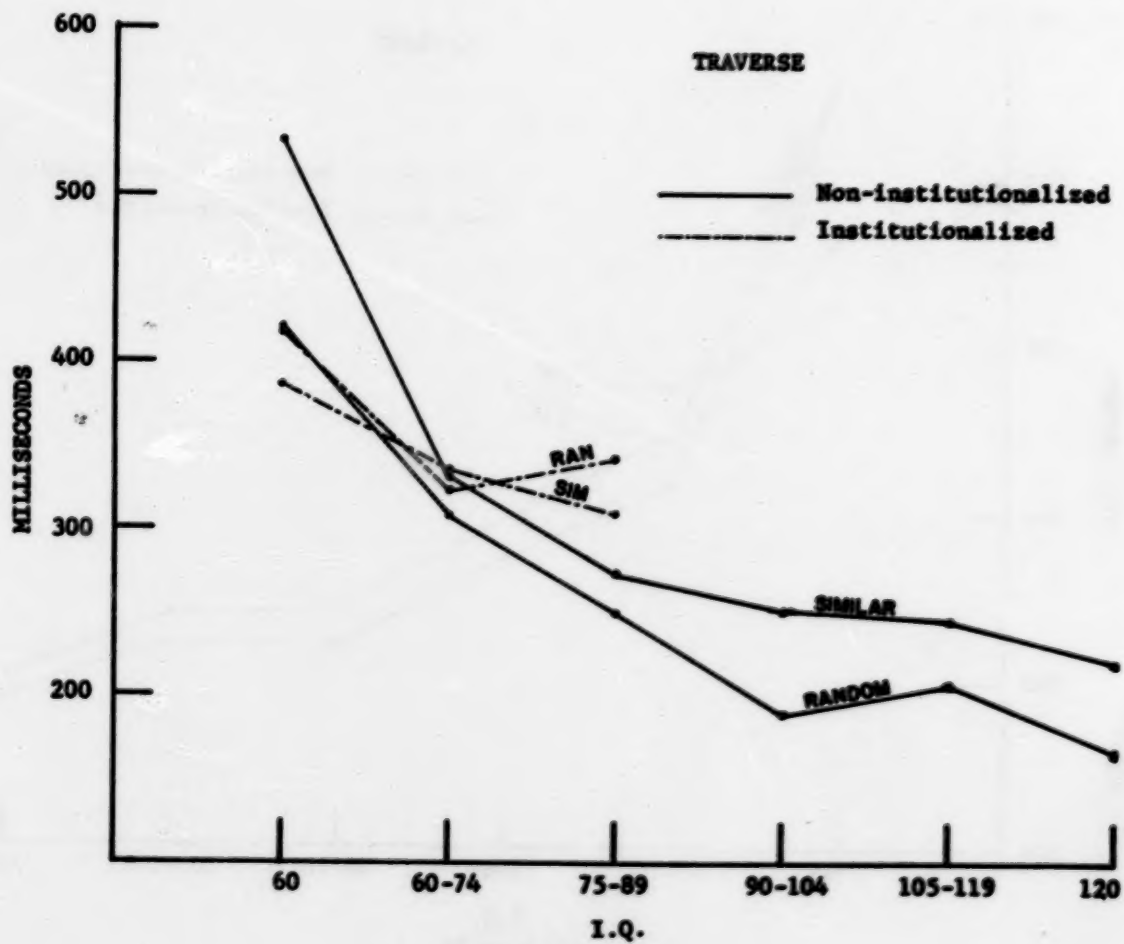
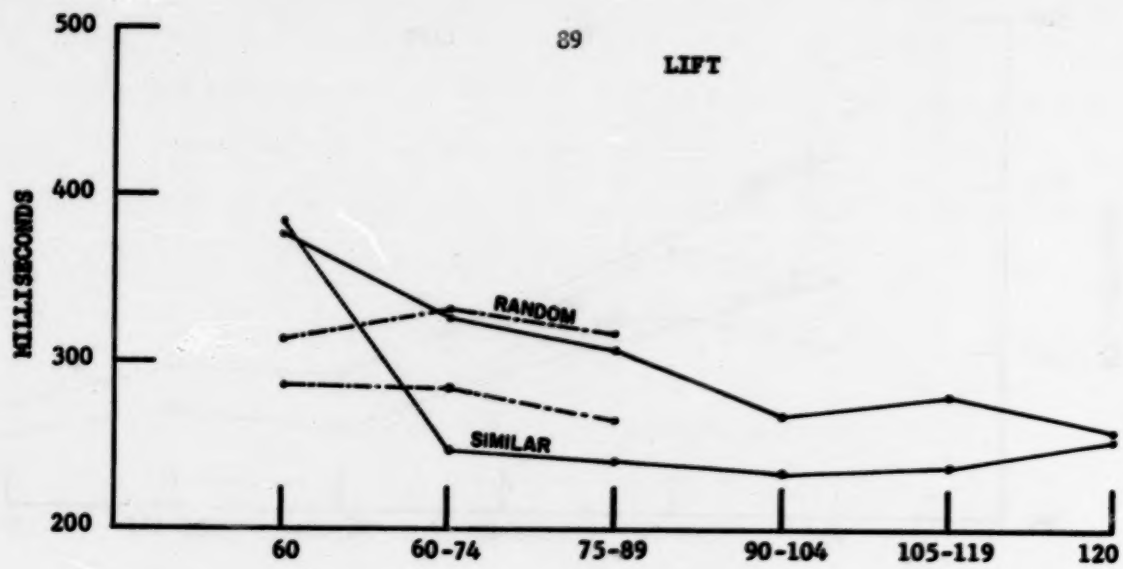


Figure 35.
Reaction time: Buzzer, by I.Q.

these conditions, there seems to be a curvilinear relationship between IQ and the two reaction times employed. Traverse reaction time is high for the low IQ's, and considerably higher than lift reaction time at these IQ's. Traverse reaction time, however, drops precipitously so that by IQ 75-39 it is about equal to lift reaction time, and thereafter continues lower.

(b) Effects of Order. It will be noted that the random reaction time is invariably greater when the stimuli are scrambled, where the measurement is the interval between the onset of the stimulus and lifting the finger. This holds for all three stimuli. In the reverse reaction times, the effects of order tend to be reversed. The reaction times, when the discriminative stimuli are similar, tend to be greater than when their order is random, except at the red light, which occasioned the lowest reaction times.

(c) Lift Reaction Time and Traverse Reaction Time. Behavior of the low IQ children can be described as a kind of dawdling, and it will be noted that they dawdled more moving to the shut-off button than in lifting their fingers from the initial button. That there is far more change in traverse time than in lift time suggests that such types of response, where there is slowness, are far more amenable to training for speed, that is, will yield more dramatic improvement in reaction-time performance than will training to react to the discriminative stimulus. The work of K. U. Smith (1951) on breakdown of performance times into the differential responses which constitute them and the differential effects of differential training upon total performance is a case in point. It will also be noted in this regard, that order has differential effects upon the two reaction times, except for the red light, which

be at some limit of performance.

(d) *Curvilinear Relations.* In Figure 36, reactions conditioned by all three stimuli are averaged, and the curvilinear relations noted previously continue. It will be noted that from IQ 90-104 on, the curves are, to all extents, straight lines, with these asymptotes being approached rapidly at the preceding IQ group. The institutionalized children, on the lift reaction time, display little change as a function of IQ, seeming to be the average of the non-institutionalized groups of corresponding IQ. For traverse time, there is drop as a function of IQ, but again, this seems to be a dampening of both extremes of performance in corresponding non-institutionalized children. The data are presented tabularly in Table 6.

(e) *Reaction Time as a Function of Age.* Reaction time as a function of age is presented for both normal and retarded groups in Figures 37 and 38, white light; 39 and 40, red light; 41 and 42, burner. These indicate that age apparently enters into the reaction time, with reaction time generally tending to drop as a function of age. The shape of the curves tends to be different from the IQ curves. An inverse S is noted here, that is, instead of the drop as a function of IQ, there is apparently a continual high level at early ages, with a continual low level at later ages, the inflection point being apparently between 13 and 14 for both types of reaction time. The relationships of the reaction times to each other, and relationships of the orders, found for the IQ curves, continue to hold, except that for normal children, traverse time is lower than lift time at all ages. The greater traverse over lift time noted in the IQ curves was for the lowest IQ groups, and these are, by definition, excluded from the normal groups. It will also

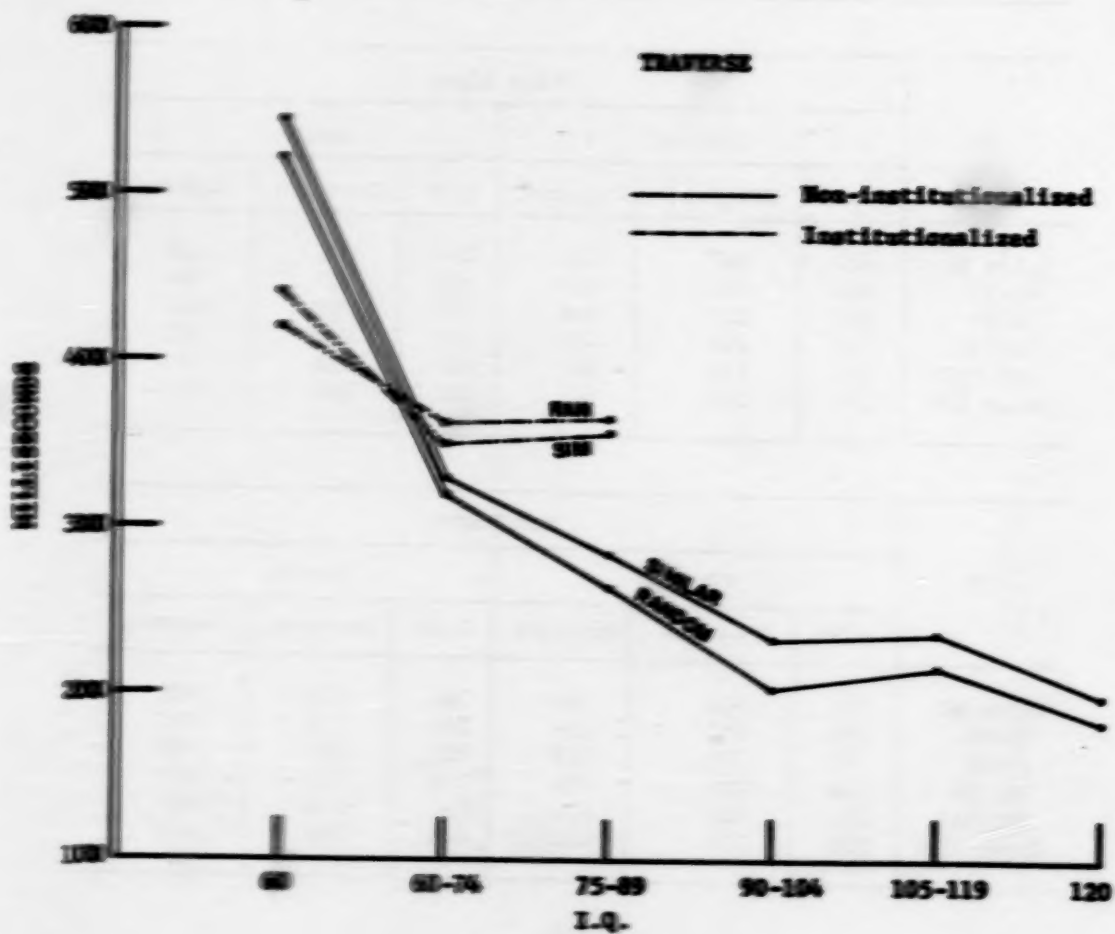
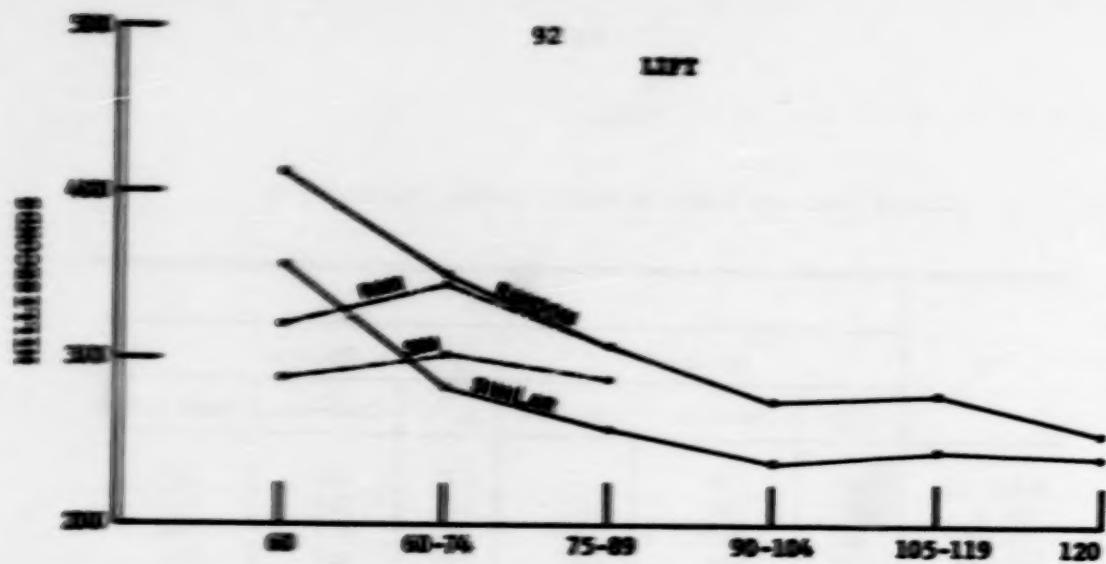


Figure 36.

Reaction time: Average Stimulus, by I.Q.

TABLE 6

AVERAGE REACTION TIMES IN MILLISECONDS RELATED TO IQ

IQ	Buzzer					
	Ordered			Random		
	Lift	Traverse	Combined	Lift	Traverse	Combined
Below 60	309	424	733	330	419	749
60-74	277	334	611	329	316	645
75-89	266	283	549	311	271	582
90-104	233	252	485	266	187	453
105-119	237	247	484	280	209	489
Above 119	253	220	473	259	167	426

IQ	White Light					
	Ordered			Random		
	Lift	Traverse	Combined	Lift	Traverse	Combined
Below 60	311	463	774	359	491	850
60-74	316	365	681	363	337	700
75-89	289	317	606	320	297	617
90-104	249	240	489	281	220	501
105-119	260	238	498	283	223	506
Above 119	245	200	445	260	186	446

IQ	Red Light					
	Ordered			Random		
	Lift	Traverse	Combined	Lift	Traverse	Combined
Below 60	297	469	766	344	478	822
60-74	305	351	656	338	336	674
75-89	270	305	575	308	289	597
90-104	236	209	445	274	198	472
105-119	245	225	470	266	219	485
Above 119	230	187	417	249	194	443

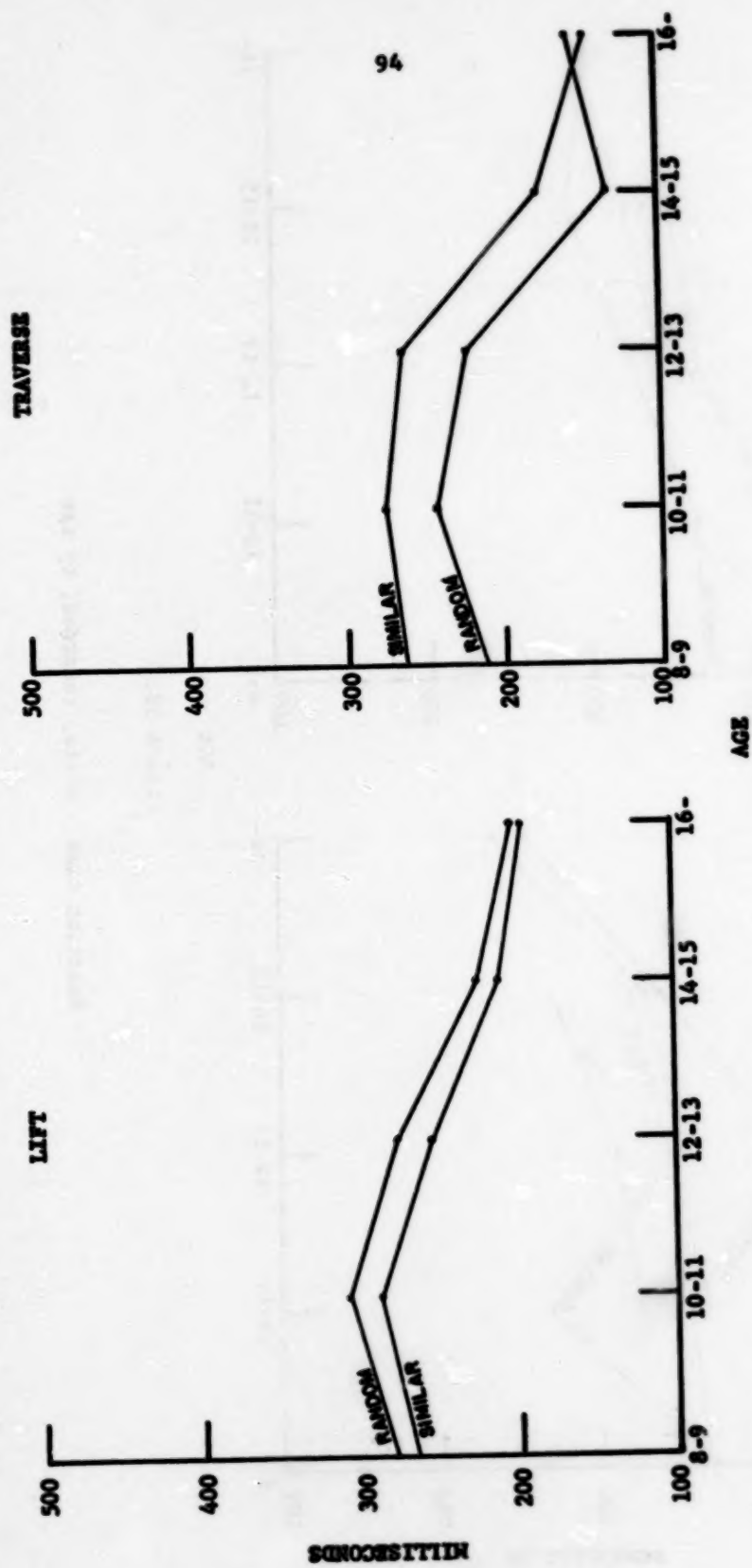


Figure 37.
Reaction time: White, Normals, by age.

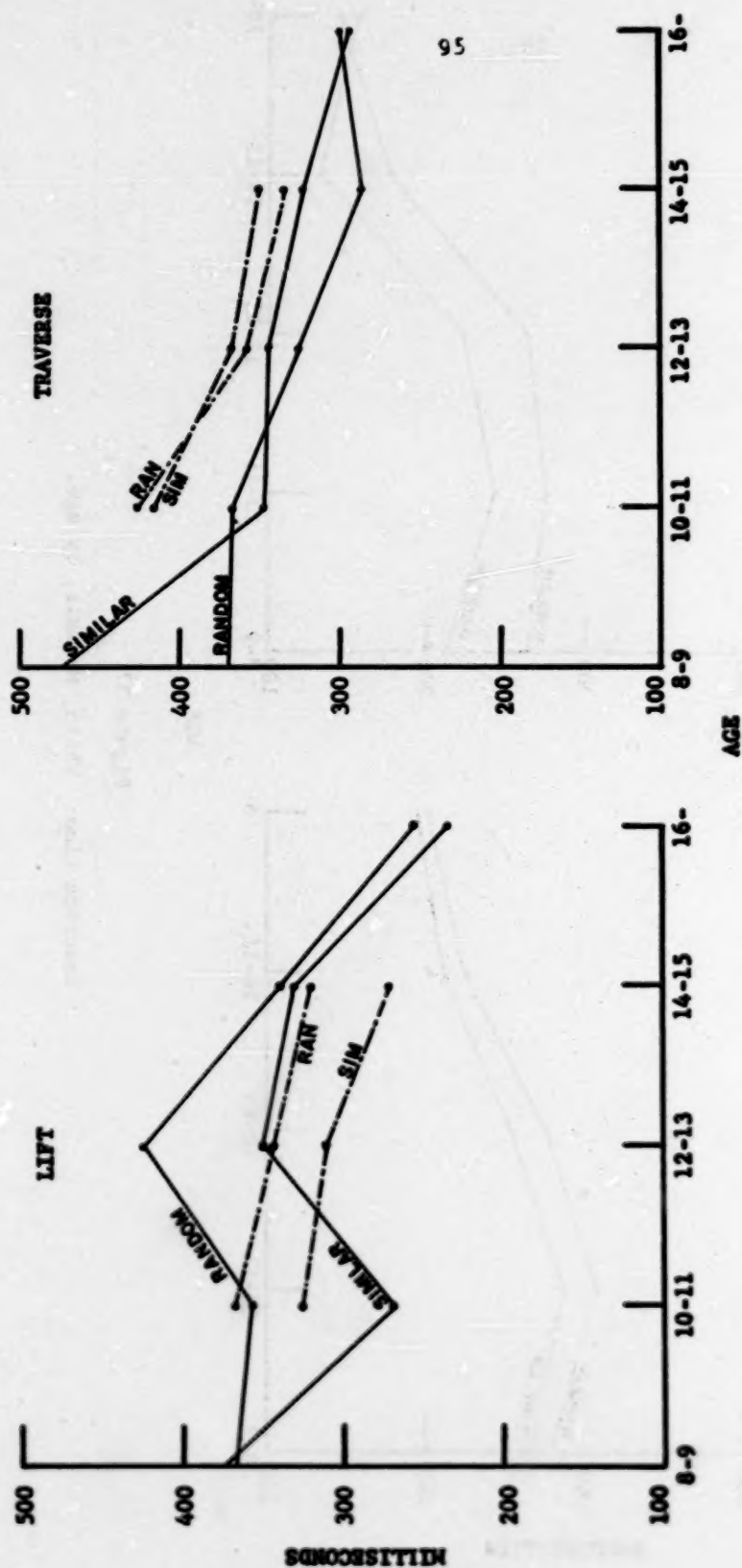


Figure 38.

Reaction time: White, retarded, by age.

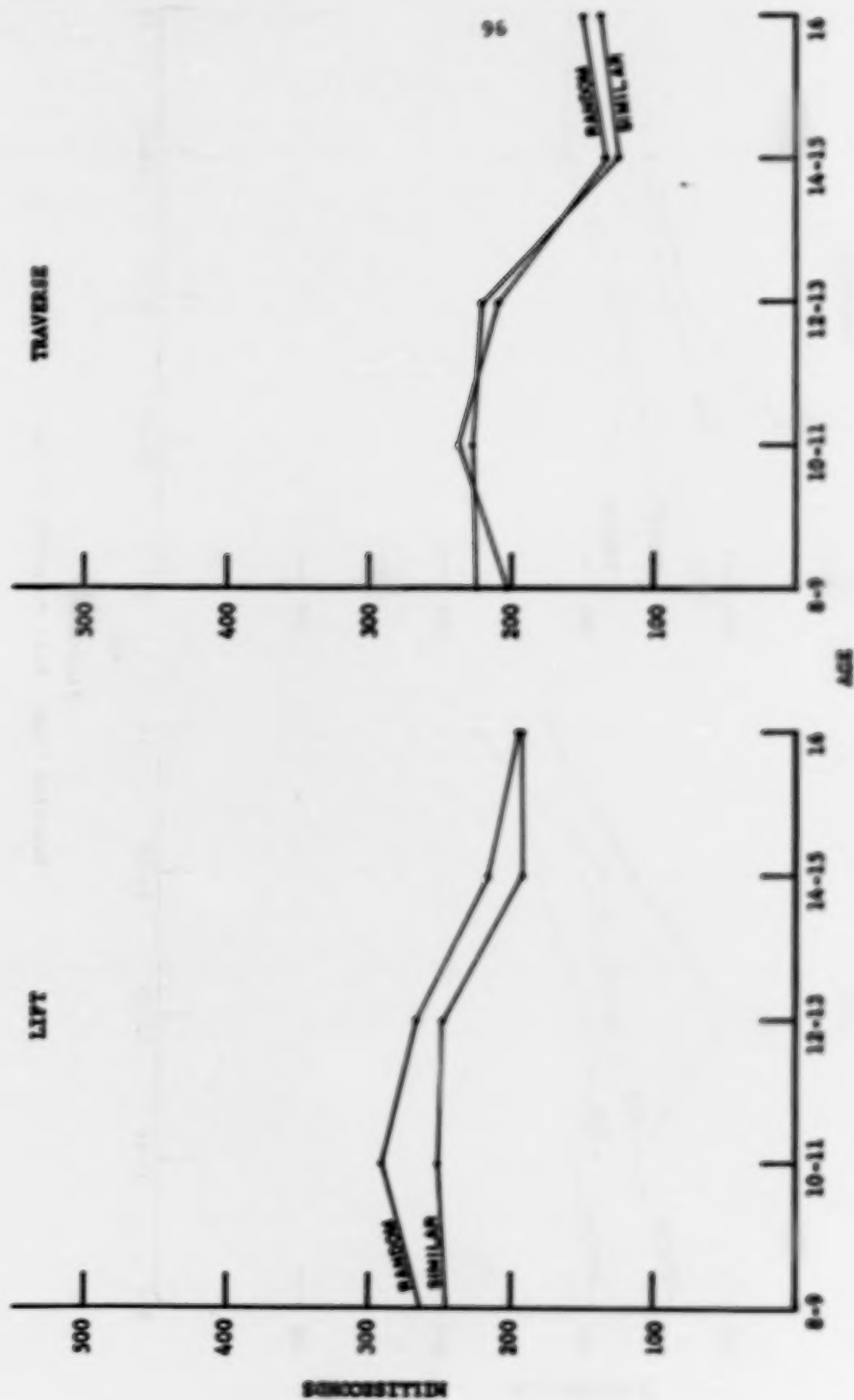


Figure 39.
Reaction time: Real, normals, by age.

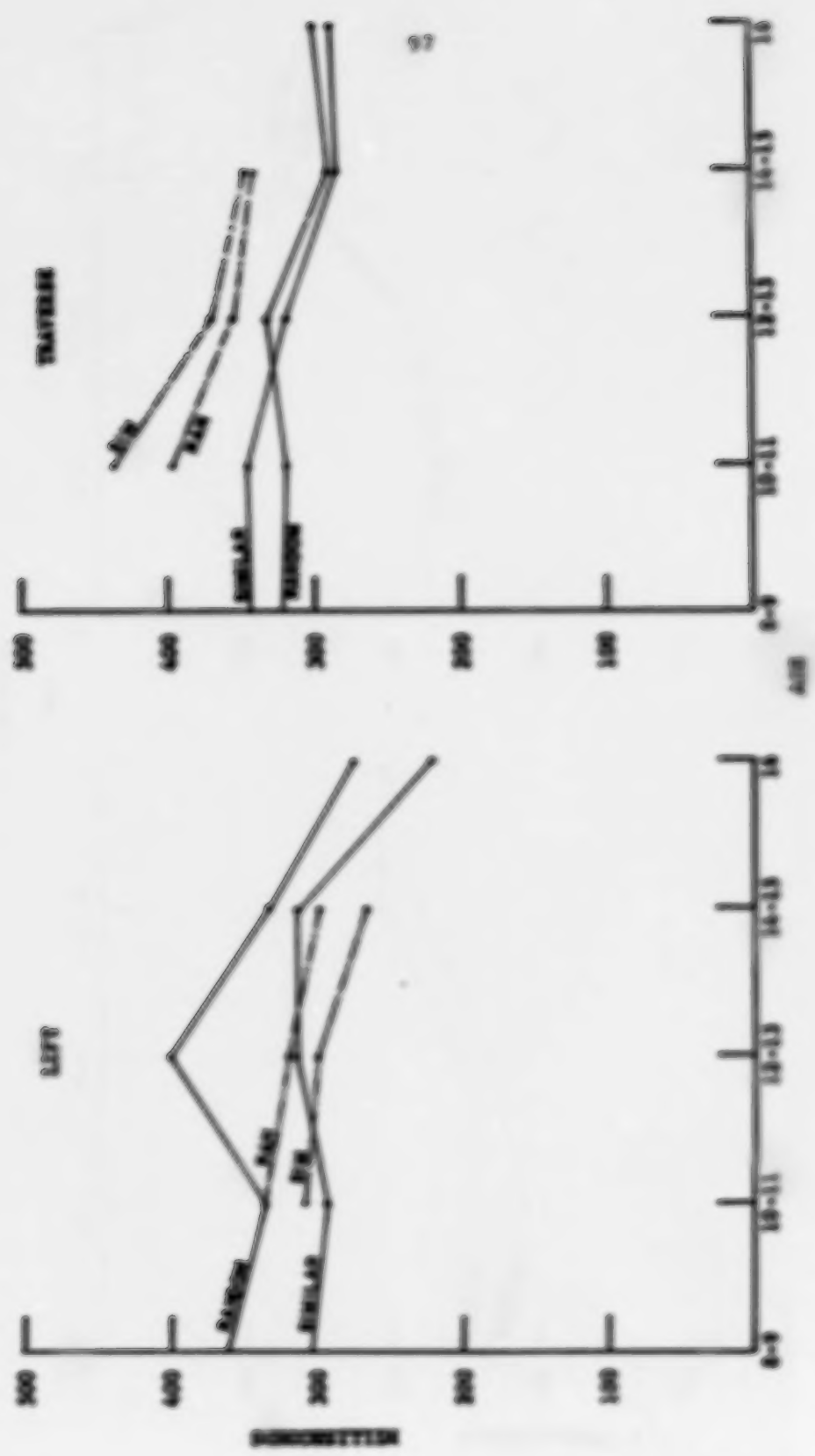


Figure 46.
Reaction time: Red, retarded, by age.

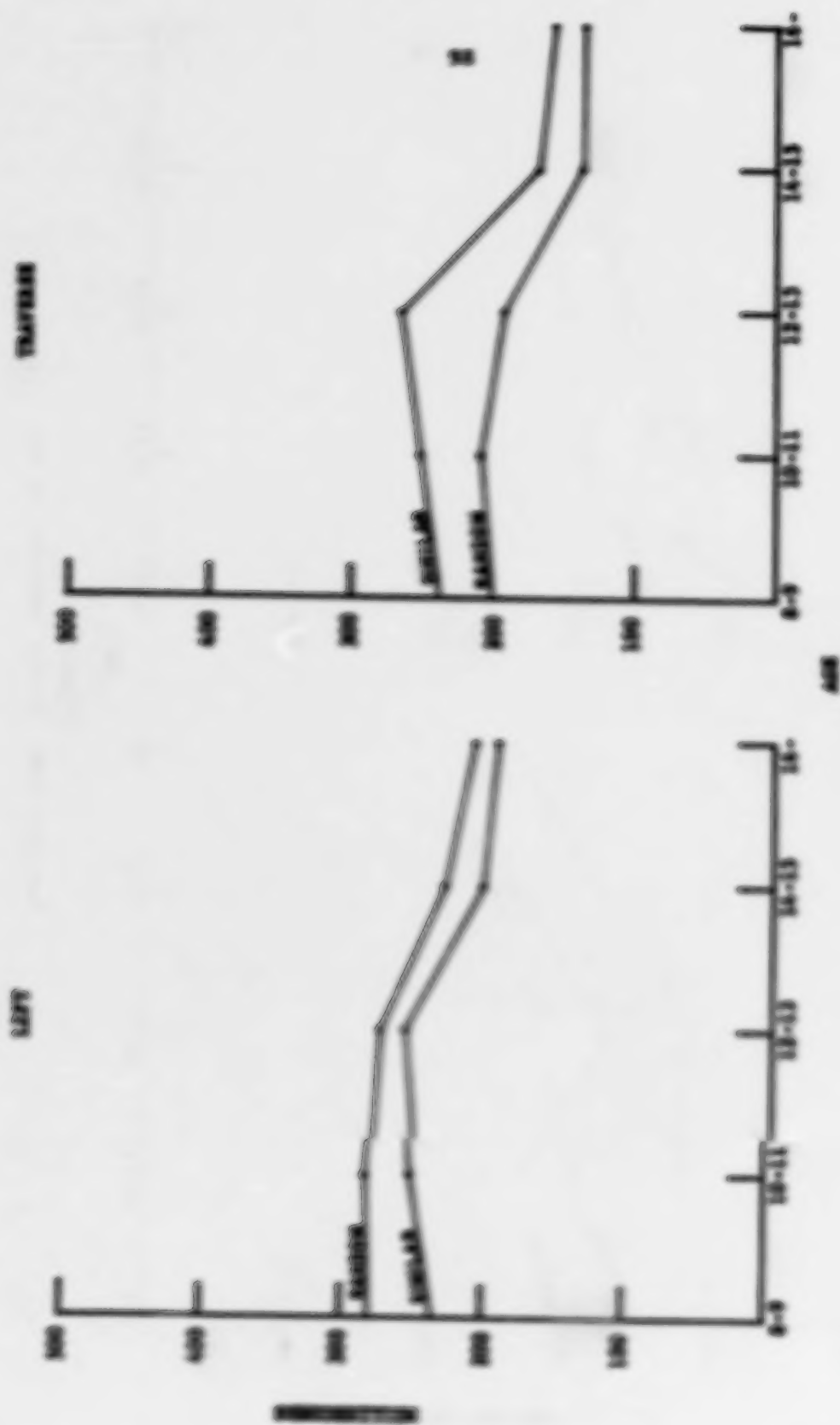


Figure 41.
Reaction time: Butter, murrelet, by age.

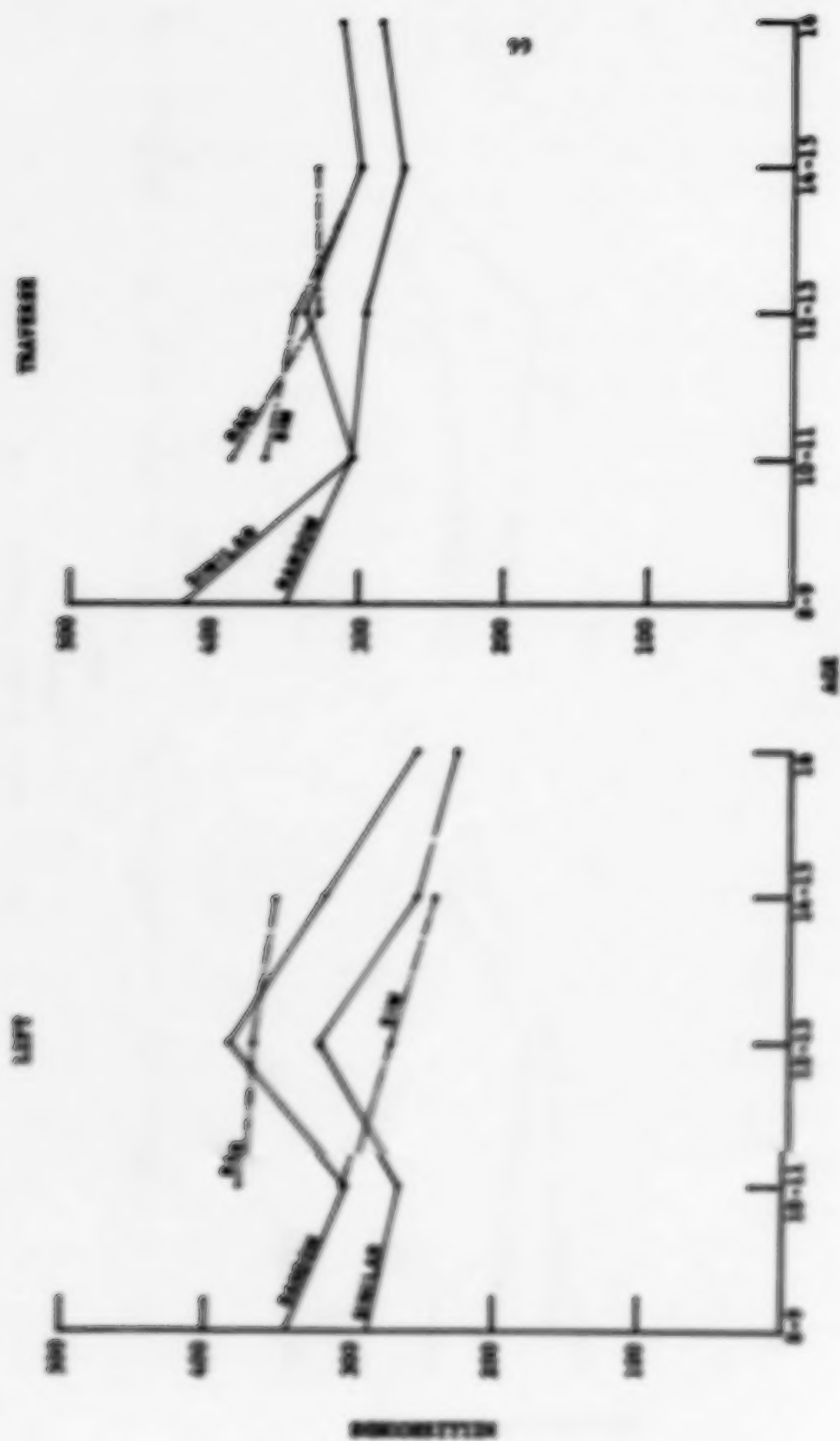


Figure 42.
Reaction time: Better, retarded, by age.

be noted, that the retarded children, as expected from the IQ curves, have higher reaction times at each age than the normal children, and also tend to have a greater range of response between the two ordered curves than do the normal children. On the lift reaction times, the institutionalized children seem to come from the same population as the non-institutionalized, but on the traverse times, are decidedly slower.

Correlations between the two types of reaction time were generally high. In the ordered series, correlations were the following: buzzer, .69; white, .64; red, .74. In the random series, these were: buzzer, .64; white, .61; red, .71. A correlation of .47 is significant at a level lower than $p = .001$. For the non-institutionalized mentally retarded, the corresponding correlations are, ordered series: buzzer, .70; white, .51; red, .55. Random series: buzzer, .48; white, .63; red, .64. All correlations are significant at a level lower than $p = .001$ except for the buzzer random correlation which is significant at a level lower than $p = .01$. For the institutionalized children, different relationships obtain. The corresponding correlations for this group are, ordered series: buzzer, .39; white, .15; red, .43. Random series: buzzer, .42; white, .38; red, .43. Correlations above .37 are significant at under the .01 level, over .34 at under the .01 level. The other correlations are not significant. Correlating ordered lift reaction time and random traverse reaction time, as well as correlating random lift reaction time with ordered traverse reaction time should give a general measure of reliability across dimensions. For the normal subjects, these two correlations run as follows: buzzer, .54, .55; white, .48, .50; red, .72, .73. Non-institutionalized children: buzzer, .48, .55; white, .19, .54; red, .59, .62. For the institutionalized children:

buzzer, .09, .23; white, .09, .27; red, .31, .32. These correlations suggest that there was considerable consistency in the performances of the normal subjects since all correlations are significant at under the .001 level. A considerable consistency was also found in the behavior of the non-institutionalized mentally retarded children. Institutionalized children, however, were not as consistent in these behaviors.

3. Summary. Reaction time seems to be a function of both age and IQ. With regard to age, both reaction times measured produced inverse S shaped functions, starting off high and dropping to low, with the inflection point around 13 years of age. Traverse reaction time was quicker than lift. With regard to IQ, a curvilinear function was found, with an initial high reaction time, and a rapid drop to an asymptote around normal IQ. There was less predictability from one reaction time to another for institutionalized children than for non-institutionalized children.

B. Size Constancy

1. Procedures. The size constancy experiment consisted of two separate tasks, both involving matching a variable triangle with a standard placed before the subject on a stand. In one task, the child watched the variable triangle directly, in the other task, he saw it through a mirror which doubled the viewing distance. Distances in the campus laboratory and the mobile laboratory differed and, accordingly, results for these two groups will not be combined.

Two orders were used, a serial order and a randomized order. The serial order was an ascending series, in which two judgments were made for each standard triangle, the triangle order starting with the triangle whose altitude was 3.3 centimeters, progressing to the 6.1

centimeter triangle and so on to triangle 21. In the randomized series, the order of presentations of triangles to be matched was 13.9, 6.1, 16.5, 11.5, 2., 8.7, 3.5. The judgment could be made with the variable triangle starting out hidden by the bottom of the window and increasing in size until it approached a maximum, or it could be made with the triangle at full size but decreasing in size until it vanished. The terms increasing and decreasing, as used in this discussion will refer to these two orders.

In the serial order, for Triangles 3.5, 6.1, 13.9, and 16.5, the order was from small to large then large to small, and the reverse for the other triangles. In the randomized series, the order was from large to small then small to large.

The variable was manipulated by the experimenter, by means of a knob behind the apparatus. The measures taken were the points at which the subjects told the experimenter to stop.

2. Variables. It should be noted that results will be systematically influenced by any reaction time variable. If the triangle is increasing, the longer the subject waits before responding, the higher will be the score. With the triangle decreasing, the longer the subject waits, the lower will be the score. Accordingly, we should expect decreasing scores to be lower than increasing scores. This relationship was found to hold on practically all judgments in the experiment.

Acting to enhance the effects of this variable is the serial effect, to which considerable attention is currently being devoted (Hess, 1939). This refers to the non-independence of responses in a series. In this case, a tendency to perseverate would raise ascending scores, and lower descending scores.

Another variable that should enter into these judgments is the size of the triangle being judged. If the triangle is very small, any error, when expressed as a proportion of the size of the triangle, should have far greater weight than a smaller absolute error when the triangle is large. This was also found to be the case. Size of the triangle will enter in yet another manner. Small triangles tend to be overestimated in size constancy judgment, whereas, large triangles tend to be underestimated. This was also found to be the case in this study.

Another variable to be considered is the effect of the mirror. One effect of the mirror is to increase the distance. This will make all triangles appear smaller. Another effect of the mirror will be to make it more difficult for the subject to use comparative cues in gauging size since the mirror serves to produce effects similar to tunnel vision, namely, serves to exclude many rays of light.

There were seven triangles presented. The largest triangle, however, produced responses which were often beyond the maximal variation of the apparatus, and this triangle was eliminated from the data.

Size constancy curves are plotted as a function of age, with the size of the triangle being the parameter in the curves to follow. Typical curves are presented, using the random method, as no systematic differences were found between random and serial methods. The ordinate represents percent of standard at which the variable was stopped. The figure 100 represents actual equality, 112 represents equality of a variable twice the size of the standard, and 88 that percent of the standard.

3. Results: (a) Normal subjects. Curves for normal subjects are presented in Figures 43, 44, 45, 46. Analysis of the size constancy data indicates that there was greater overestimation for smaller triangles

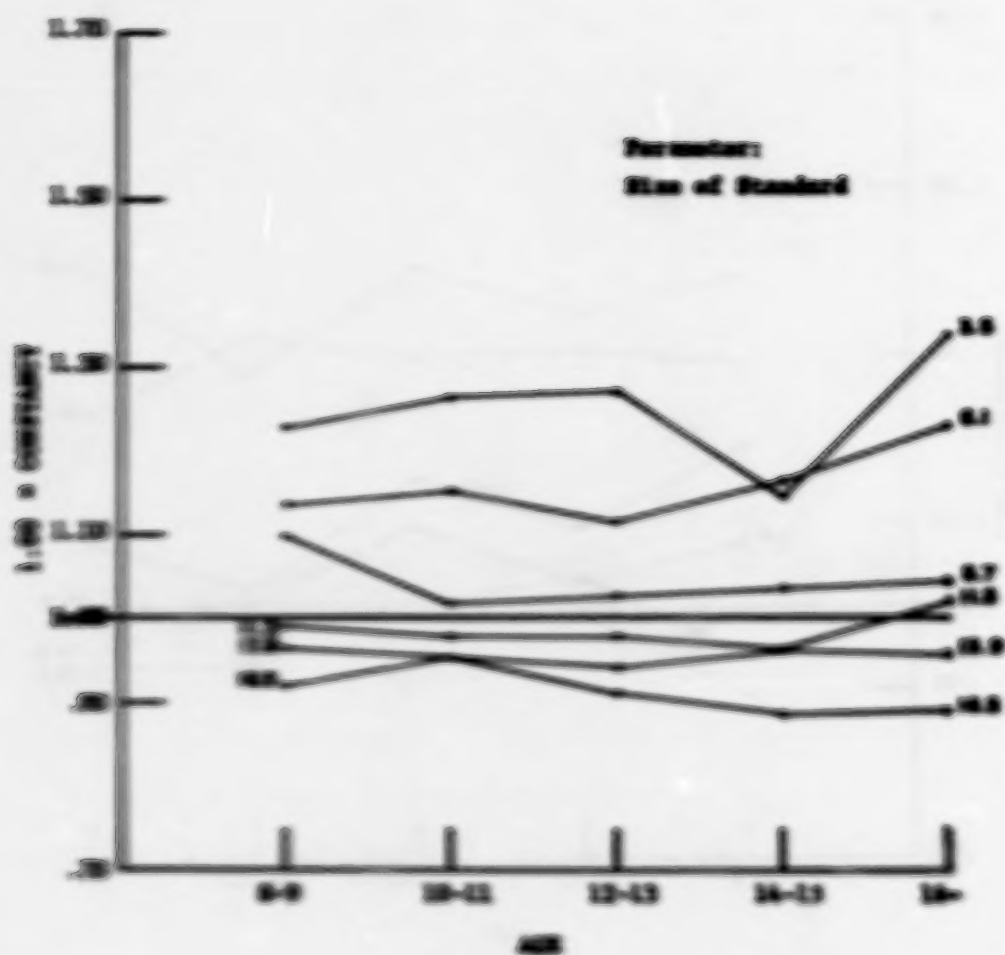


Figure 41.

Size consistency and age: Direct, random, forward, Reverse by size.

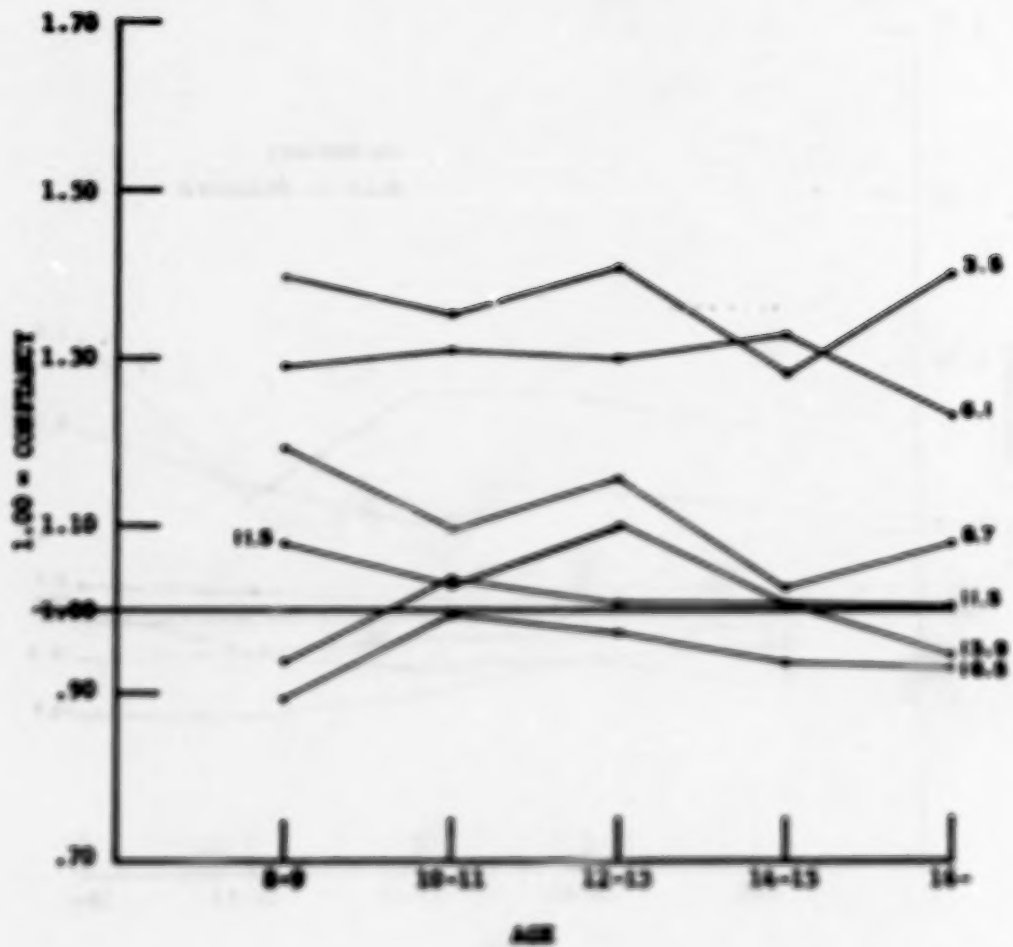


Figure 44.

Size constancy and age: Direct, random, second, Normals by size.

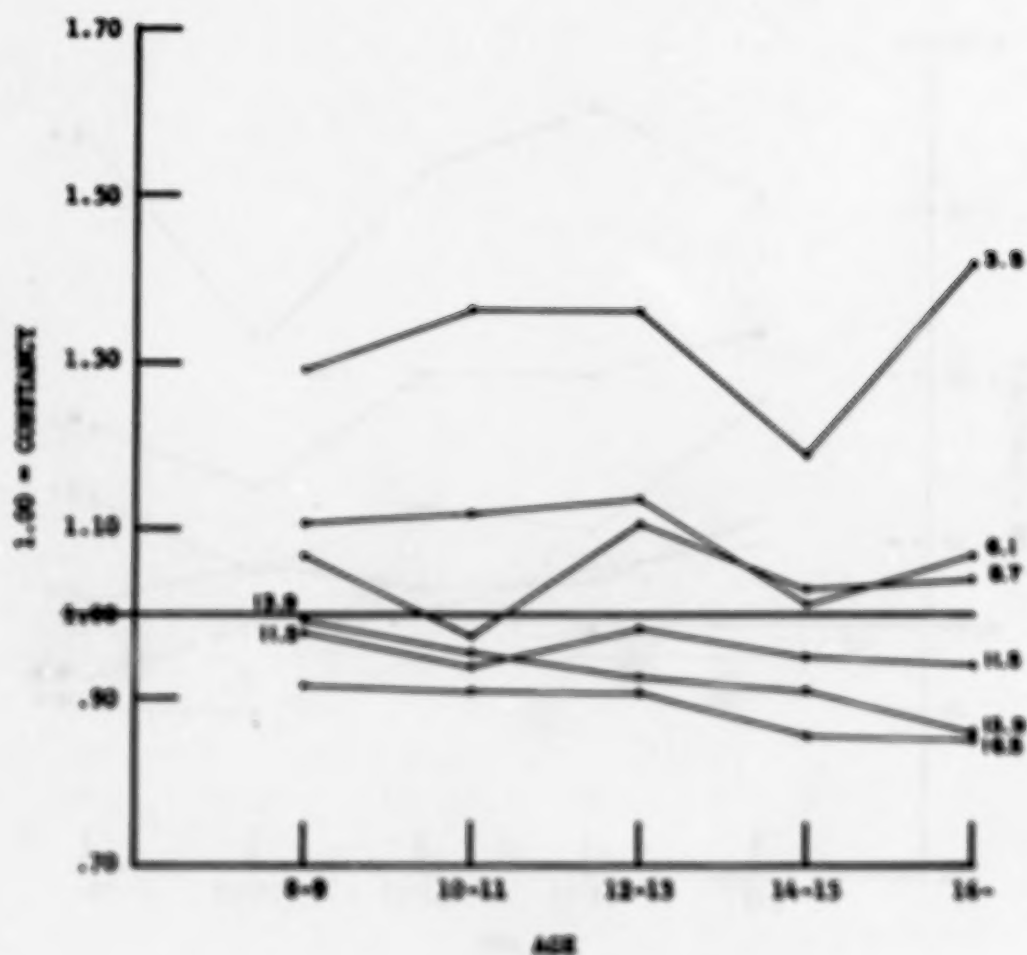


Figure 43.

Size constancy and age: Mirror, random, descend, Normals by size.

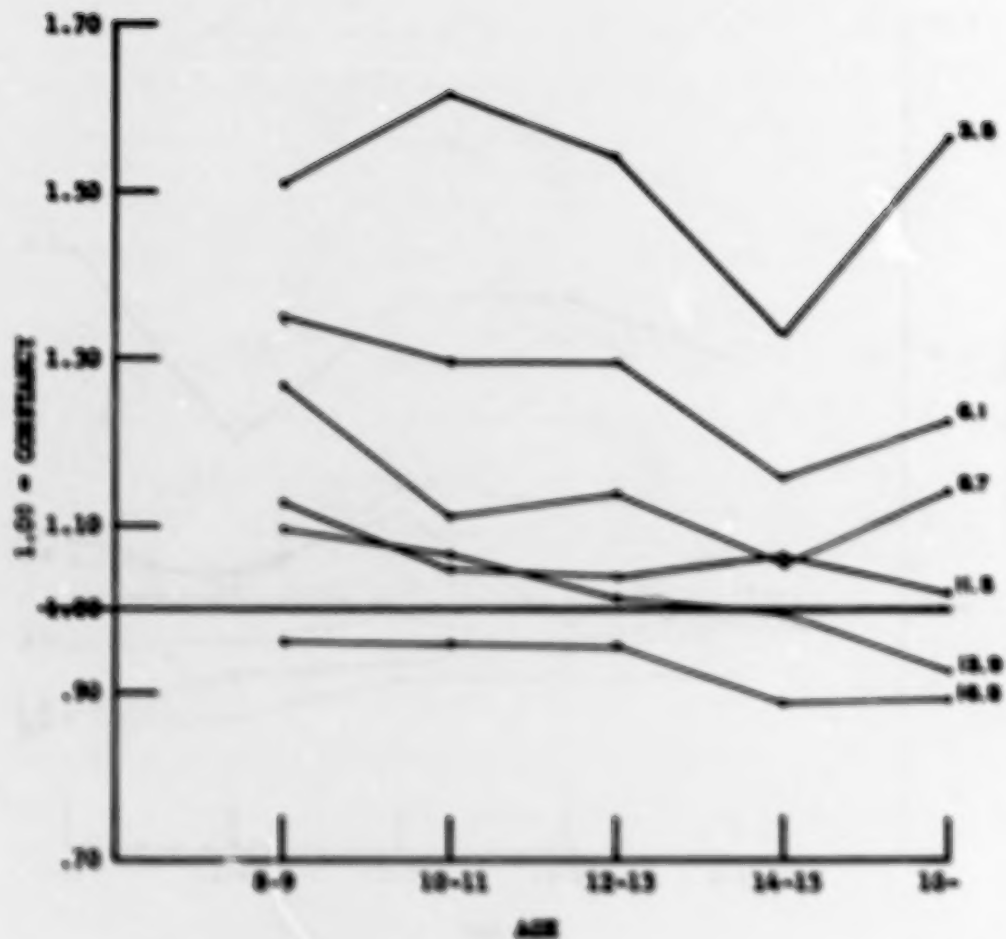


Figure 44.

Size constancy and age: Mirror, random, ascend, Normals by size.

than for larger, for mirror judgments (which rendered triangles smaller) than for direct judgments, and for ascending judgments than for descending. The differences in judgments for triangles of different sizes can be explained to some extent in terms of the mathematical effects of errors, and possibly in terms of response tendencies away from extreme judgments which would provide a response "regression toward the mean", that is, underestimation of a small triangle will tend toward zero judgments, overestimation will not, hence the tendency toward overestimation of smaller figures. The differences between ascending and descending can be explained to some extent in terms of reaction time. The lowest scores should be found in a direct descend method, and comparison of Figure 43 with the others indicates that this is the case. The three larger triangles were underestimated, while the three smaller were overestimated. Comparison of this figure with the other three indicates the other relationships mentioned, namely, smaller over larger, mirror over direct, ascending over descending. Of greater interest is that when total error, that is range between judgments, is lowest, there seems to be no ascertainable relationship between size constancy and age, at least for the ages represented here. As these errors are allowed to increase, however, a relationship with chronological age seems to emerge, that is, the error tends to decrease with age, as seems to be the case in the curves under conditions maximizing error, in Figure 46, where normal subjects use the mirror ascending procedure. Since size constancy is the inverse of error, size constancy may apparently increase with age only to the extent that errors of the type discussed are incorporated into the experimental procedure. Where they are eliminated, this relationship does not obtain. In summary, then,

that seems to be developing as a function of age is control over these errors, which can be considered to a large extent, at least, as response errors. Stated otherwise, stimulus control over the response may be developing.

(b) Retarded Children. Corresponding curves for IMH subjects are presented in Figures 47, 48, 49, and 50. Relations between the major variables discussed continue to hold, but these subjects display greater error range than corresponding normal subjects. The least difference between ranges occurs, as would be expected, in the direct descend groups, where only the curve for the smallest triangle is higher for the IMH subjects than it is for the normals. In the other curves, the overestimation is greater at practically all ages for judgments at triangles 3.5, 6.1, 8.7, and 11.5. Some differences between ascending and descending curves should be noted. If reaction time is the major variable here, then descending curves should be lower than ascending curves, as indeed they are. Since the reaction time of retarded children is greater than that of normal children, their ascending curves should be higher than those of normal children, as indeed they are. However, the descending curves should also be lower not only than their own ascending curves (which they are), but also of the descending curves of the normals, which they are not, being higher instead. Accordingly, there must be considered as entering into the behaviors of the retarded children some behaviors which result in general overestimation, above and beyond reaction time effects. These effects, as well as the others discussed, are strikingly evident in the curves of the institutionalized children, presented in Figures 51 and 52.

(c) Size constancy and π . Size constancy curves as a func-

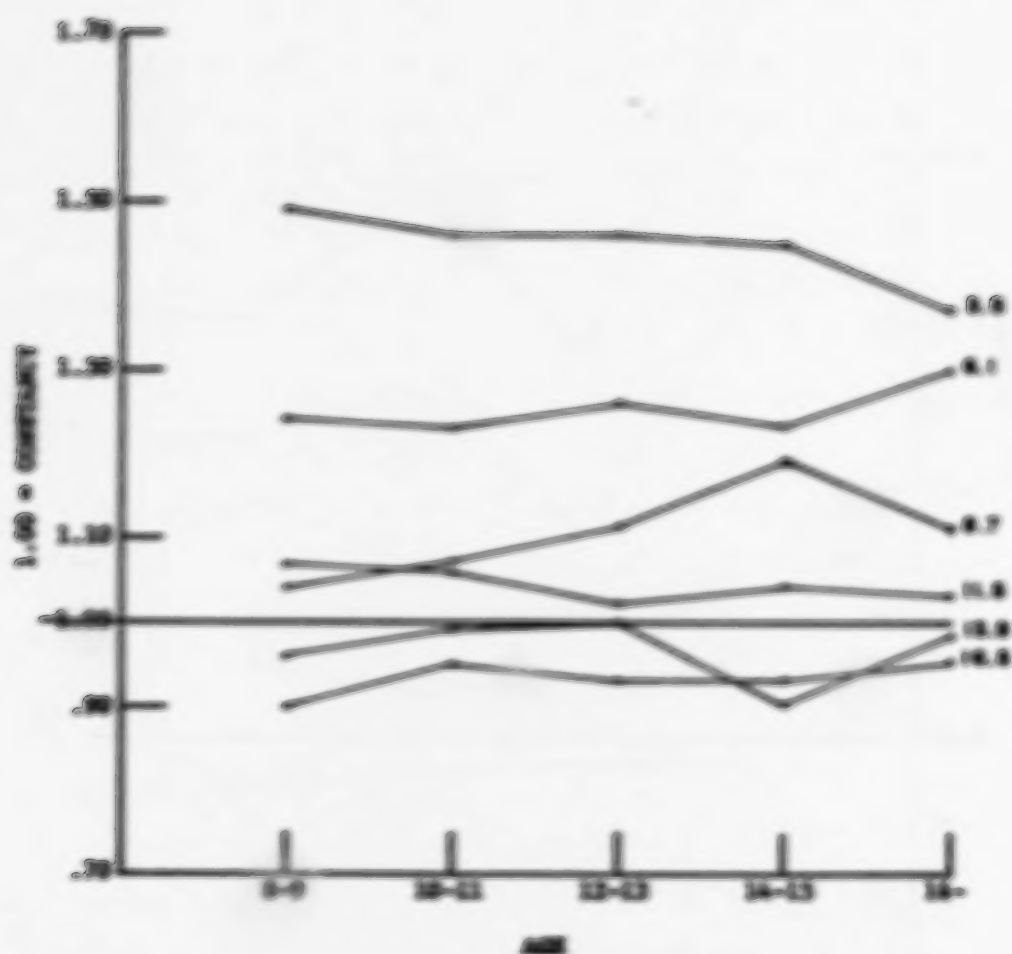


Figure 47.

Size constancy and age: Direct, mirror, demand, E.E.E., by size.

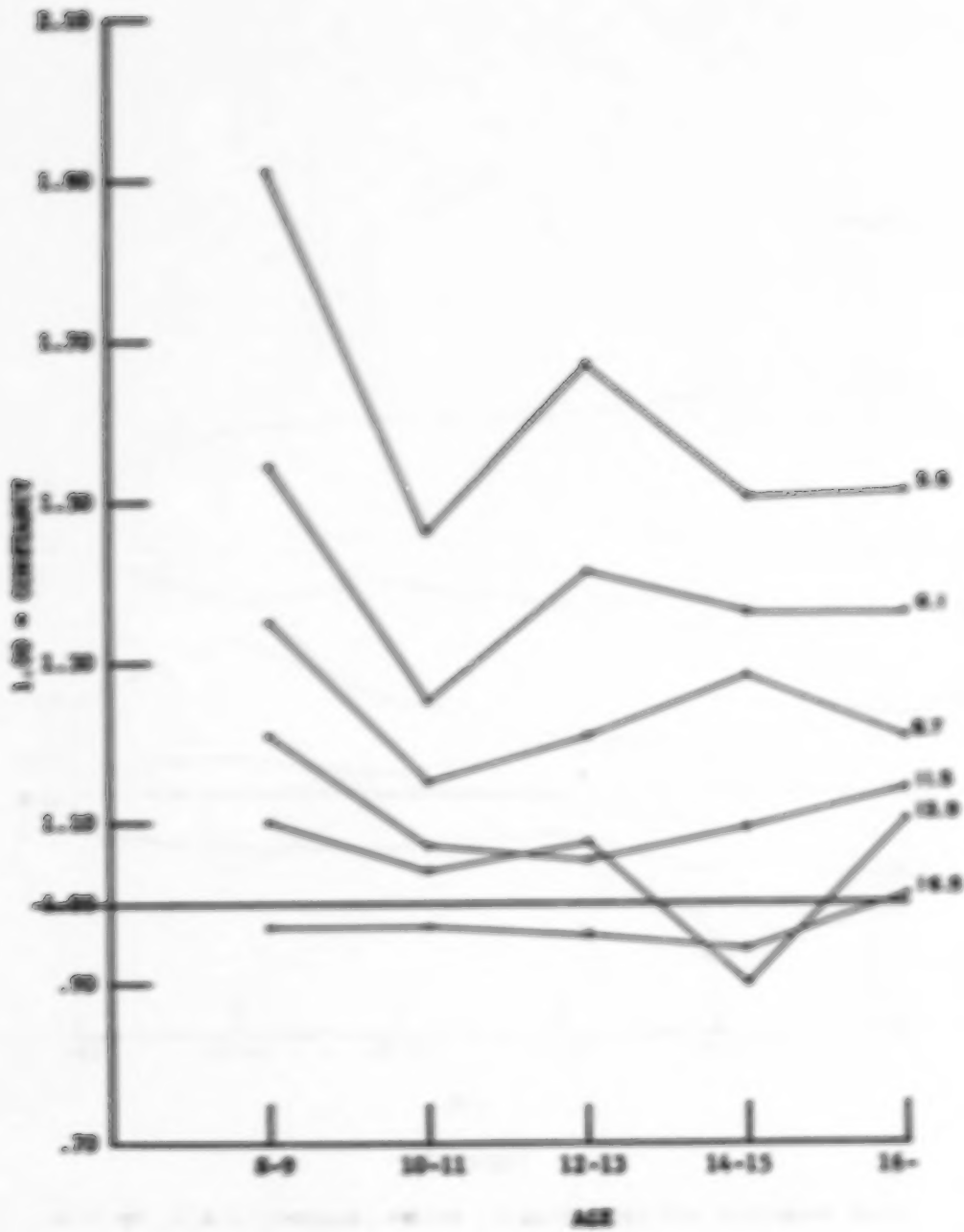


Figure 48.

Size constancy and age: Direct, random, ascend, E.M.S. by size.

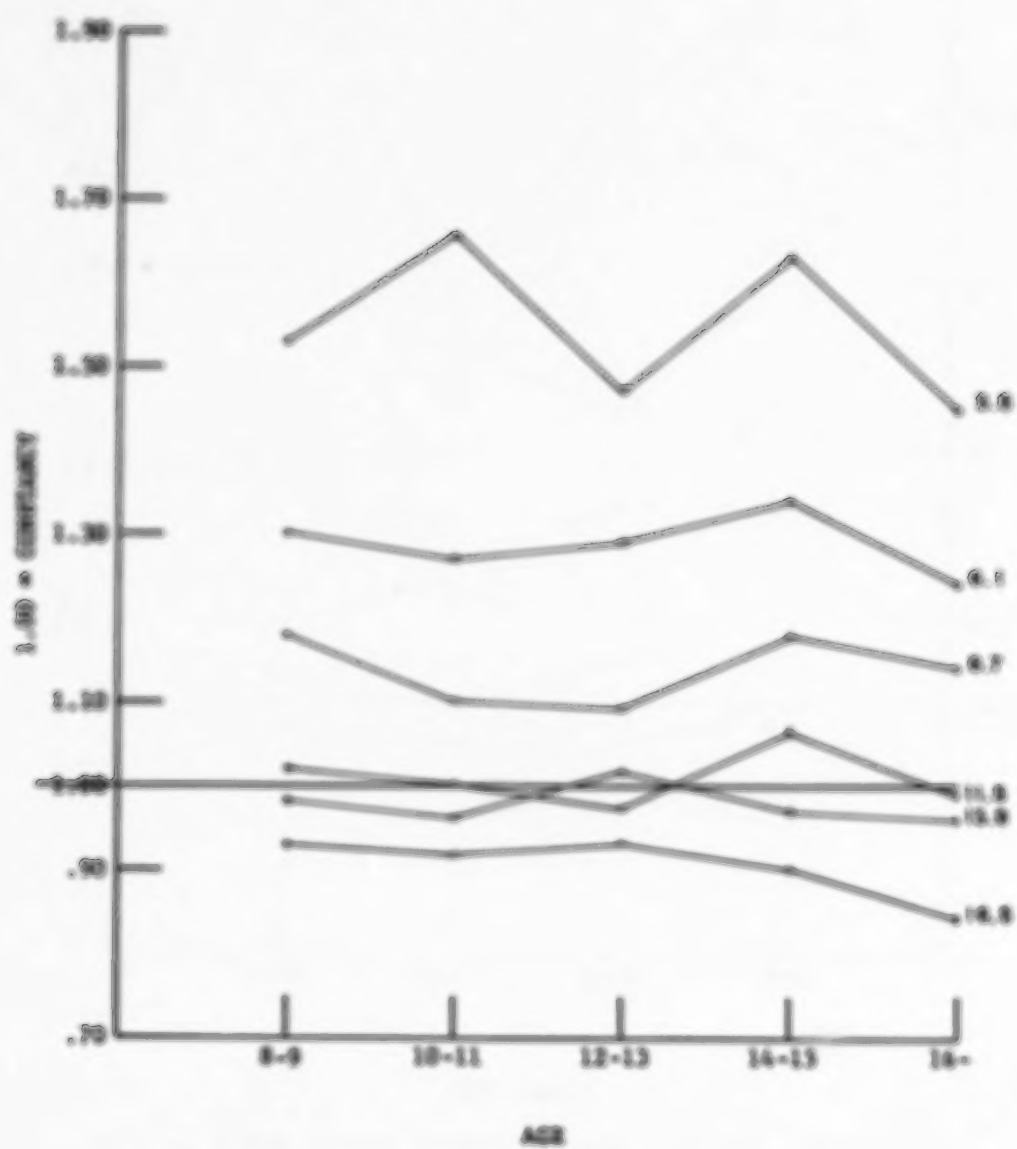


Figure 49.

Size constancy and age: Mirror, random, descend, E.H.E. by size.

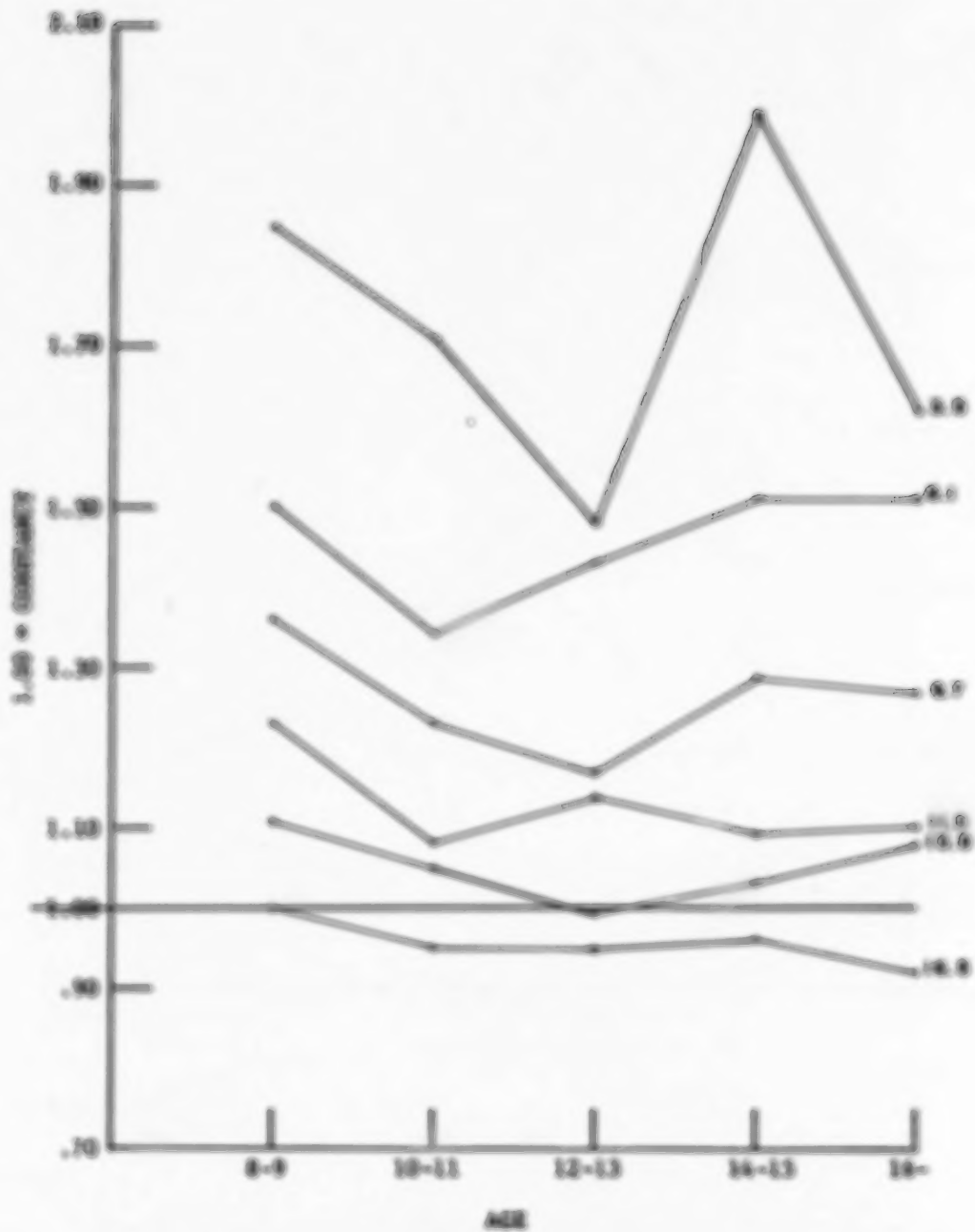


Figure 30.

Size constancy and age: Mirror, random, ascend, E.M.S. by size.

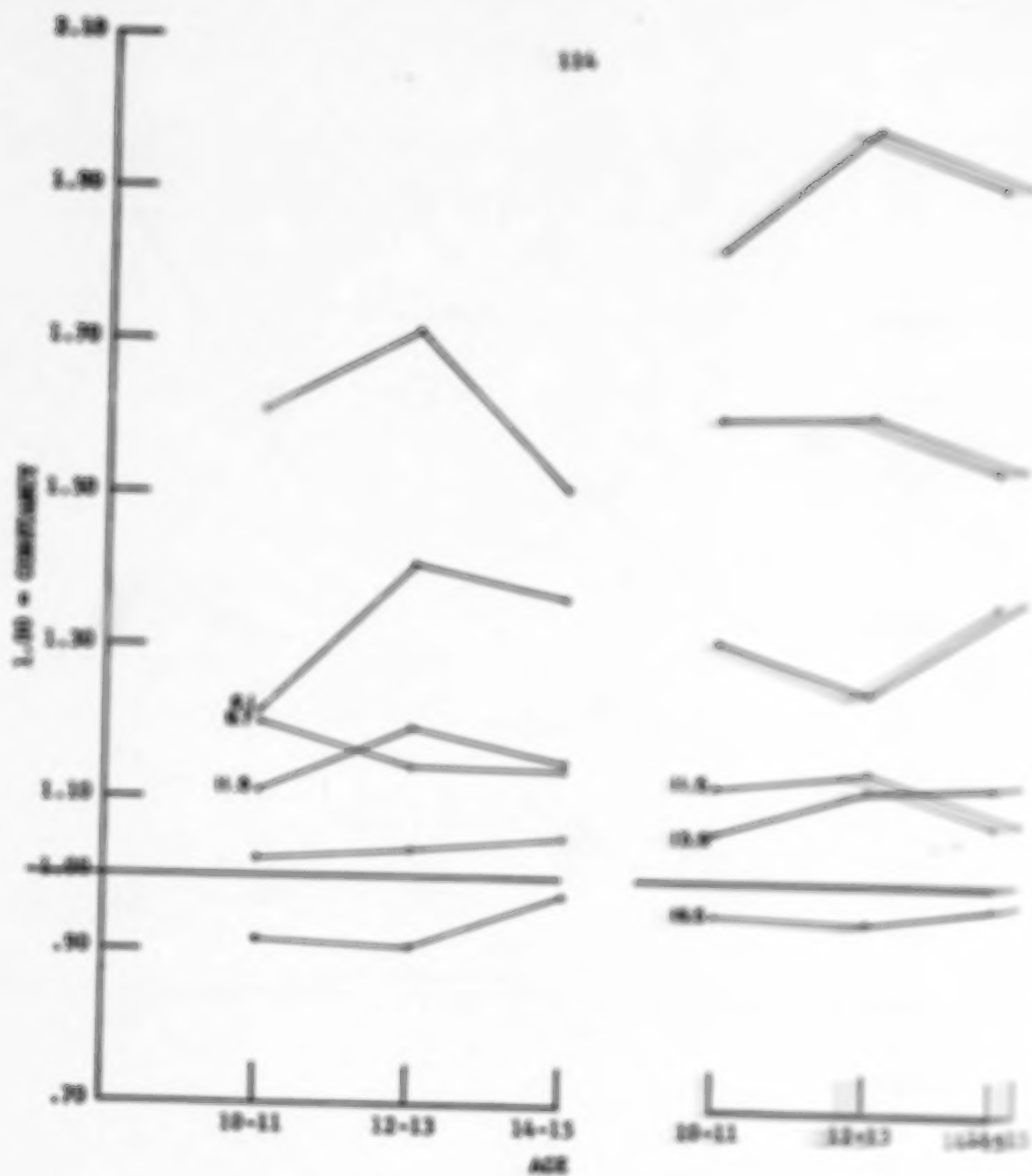


Figure 51.

Size constancy and age: Mirror, random, descend & ascend, 2.M.D., by age.

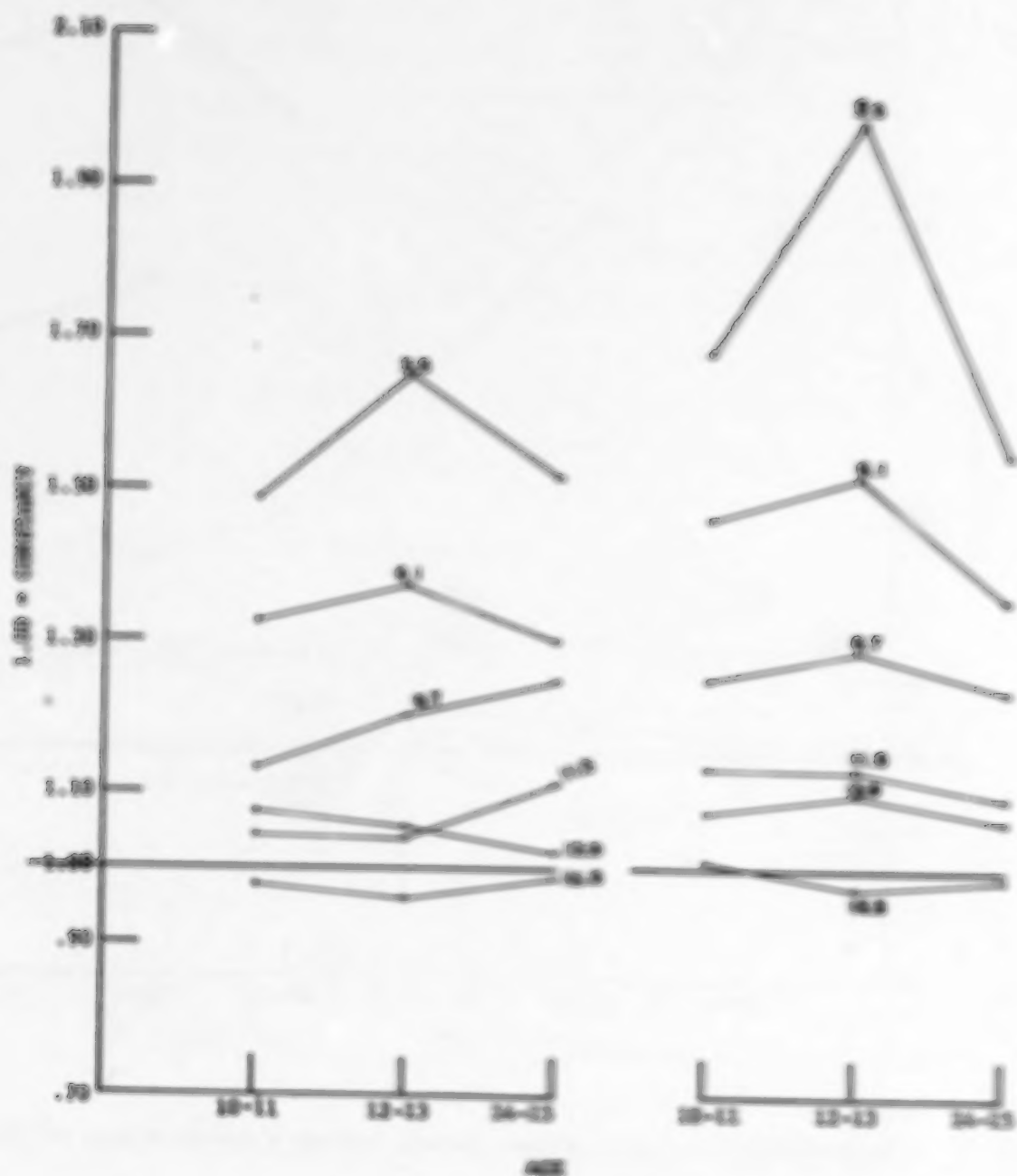


Figure 12.

Size constancy and age: Direct, random, downward & upward, I.R.S. by size.

size of Σ are presented in Figures 11, 12, 13, and 14 for the four main-variables discussed. Again, with a few exceptions an inverted pattern (such as the stress main effect, Figure 11, for the least Σ group), such as could be expected by chance, secondary curves are lower than secondary, lower is lower than stress, and large triangles are less consistent than small.

That is used to these curves is the relationship of size consistency to Σ . The consistency apparently seems to increase (that is, consistency decreases) as a function of Σ . The reversal in the right age group may be a function of the smaller sample studied. It can be noted further that the error factors cited may seem to be that is changing as a function of age, and also that there were practically no differences between small and Σ groups where these error factors were involved. These data suggest that these factors may be that is related to the Σ relationships apparent from the curves.

6. *Intensity of reaction.* The consistency judgments seem to be affected by the following variables, in the manner indicated. Increase in size of triangle leads to greater consistency, until direction of error reverses when they become large; stress viewing produces greater consistency than stress viewing; and secondary error produces greater consistency than secondary, within the size reversal effect noted. Where confusions as well as to involve consistency, size consistency was found to be independent of chronological age for the ages studied, and consistently independent of the usual-oriented variable. Where consistency was involved, it became a function of age as well as of Σ group. Since size consistency was also found to be an increasing function of Σ , it was suggested that the response variables discussed may have been

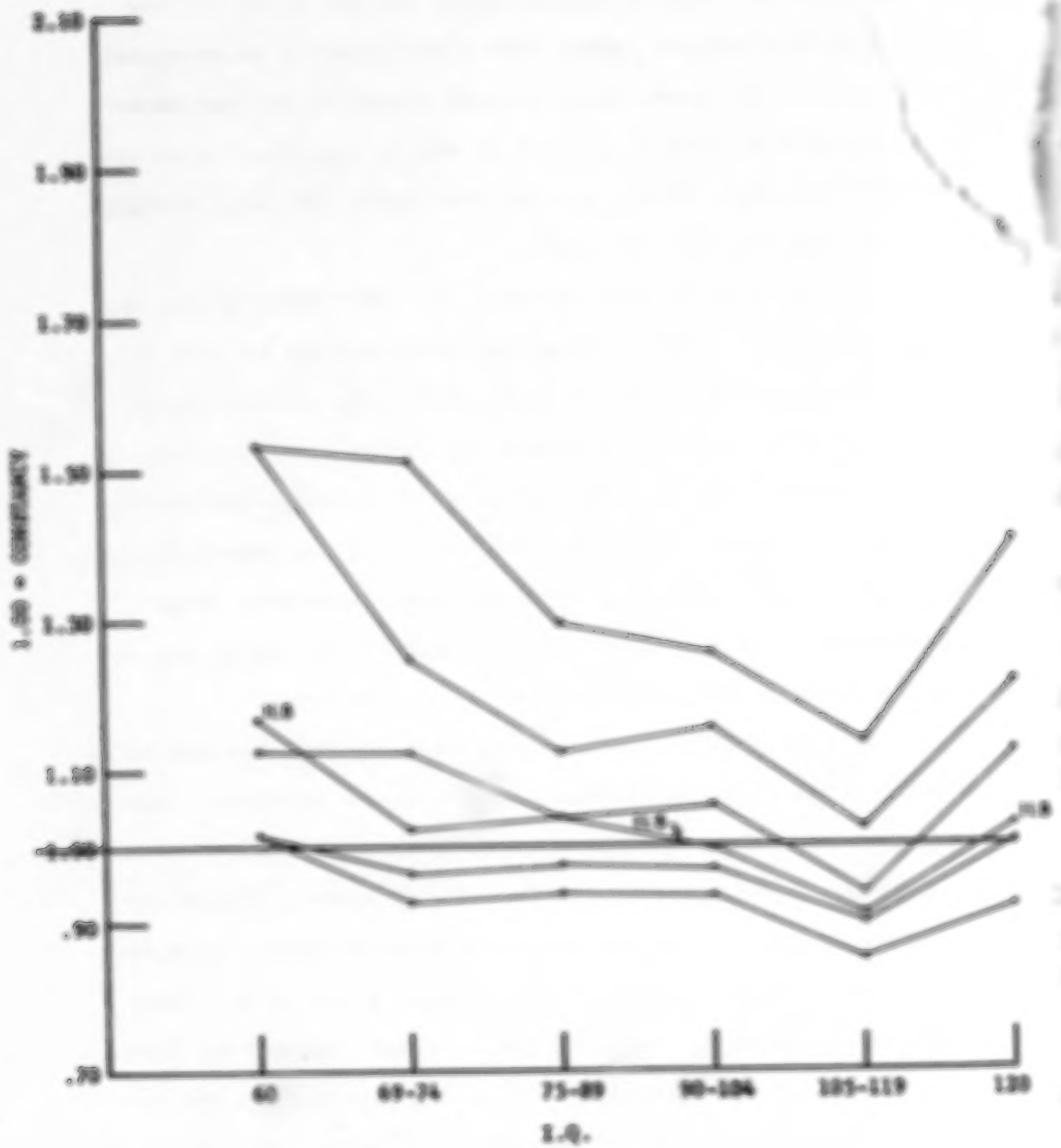


Figure 13.

Size constancy and I.Q.: Direct, random, desc. and, noninstitutionalized by size.

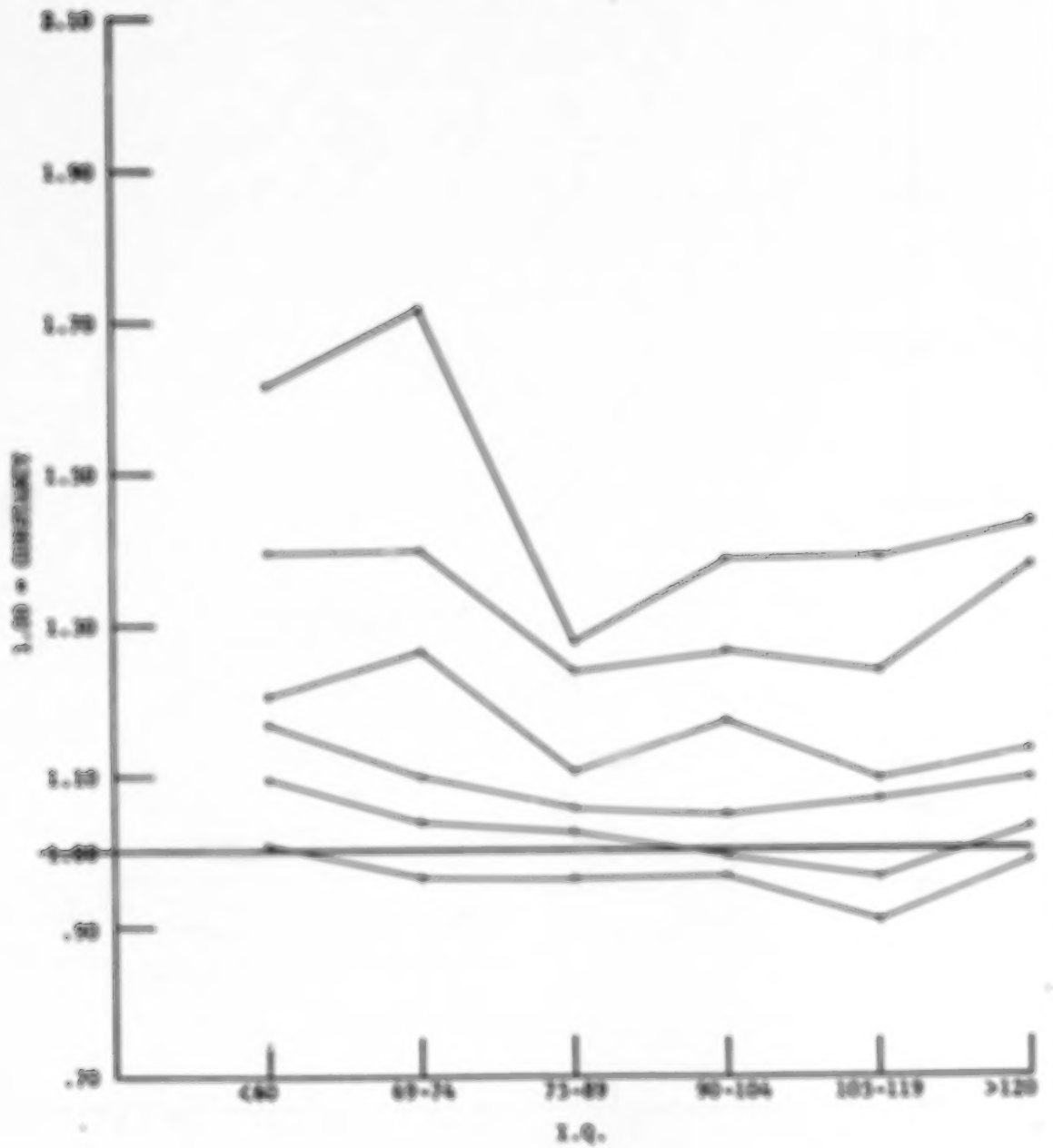


Figure 34.

Size constancy and I.Q.: Direct, random, ascend, noninstitutionalized by size.

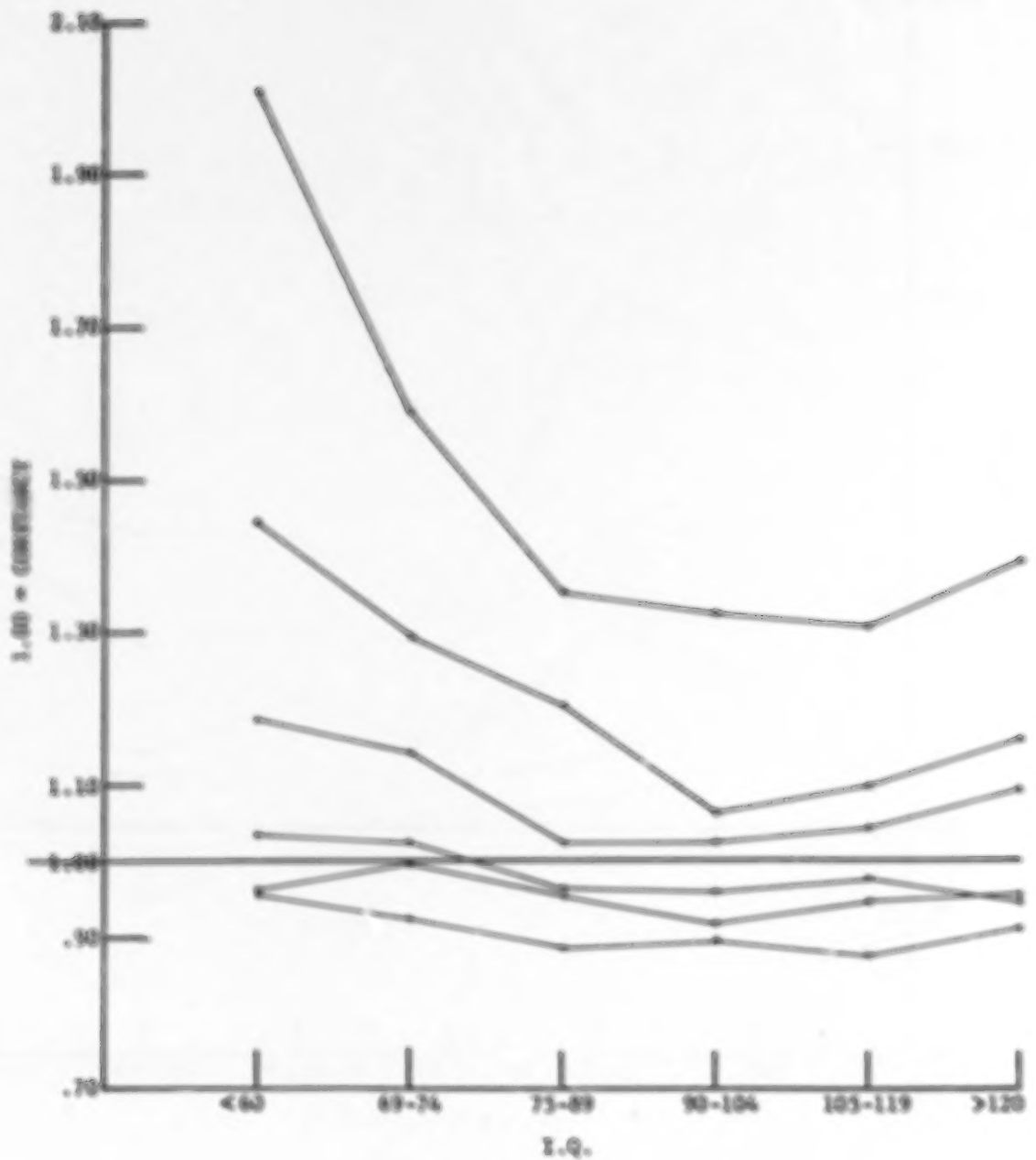


Figure 55.

Size constancy and I.Q.: Mirror, random, descend, noninstitutionalized by size.

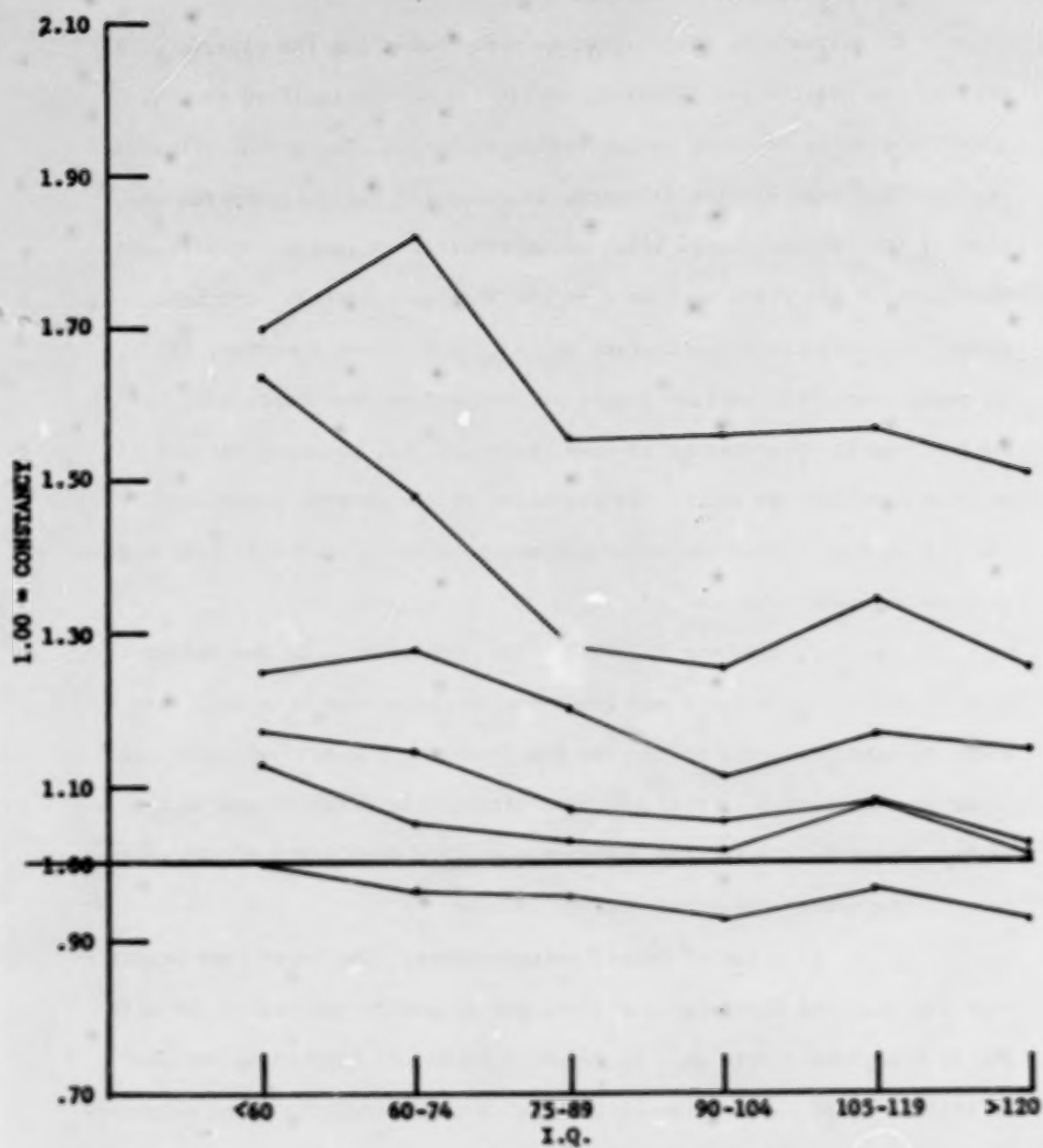


Figure 56.

Size constancy and I.Q.: Mirror, random, ascend, noninstitutionalized by size.

responsible for this relationship.

C. Illusions. Two illusions were chosen for the experiment. One was the Muller-Lyer illusion, consisting of the familiar arrows. This illusion is reported as decreasing with age. The second illusion was the Titchener circles illusion, in which the subject compares the size of two circles. This illusion is reported as increasing with age. Both sets of illusions were used in the Thurstone battery, and have found continued use in perceptual tests (e.g., Wapner & Werner, 1957). In these tests, the various plates are printed on one sheet, with the subject usually required to go down it (or up it), pointing out the pair he considers as equal. In the tests of the present experiment, the plates were separated, presented one at a time, with different orders used on the same subjects.

1. Muller-Lyer Illusion. (a) Procedure. In the Muller-Lyer illusion, the subject was given twelve cards, one at a time, and asked to make judgments concerning the illusion. In all judgments, the cards were presented so that the open part of the illusion was on the right. Two orders were used and four questions were asked of the subjects. The series presented were as follows:

(1) Serial Order, Forced-Choice. The cards were presented with the open end initially smallest, and gradually increasing until it was at a maximum. This will be referred to as the descending series. It will be noted that if the closed end is considered the point of reference, the series called ascending is descending, and the series called descending is ascending. In these two series, the subject was required to indicate at each presentation whether the left side or the right side was the larger.

(ii) Serial Order Equality. The series was presented in an ascending manner as before and then a descending manner with the subject required to indicate in each series the card in which the two sides were equal. There were four ascents and four descents.

(iii) Random Order, Forced-Choice. Cards were randomized in the following order: 3, 1, 8, 7, 4, 12, 6, 11, 9, 2, 5, 10. The randomized order was then reversed for simplicity of presentation, with Card 10 first, and Card 3 last. In the first series, the subject was asked to state Yes or No as to whether the left arrow was larger than the right. In the second series, the subject was asked to state Yes or No if the right was larger than the left.

(b) Results. (i) IQ. Results are presented in terms of percent of illusion, that is, when the sides were judged to be equal, the ratio of the variable to its size when physical equality occurred. Left and right responses were rearranged into an ordered series, and the P.S.E. (Point of Subjective Equality) was obtained by standard methods (Guilford, 1954).

Illusion and IQ. Overestimation of the variable size in the Muller-Lyer illusion is presented as a function of IQ in Figures 57, 58, and 59, which include data from the different methods. The IQs utilized are for the non-institutionalized subjects only. It will be observed from these figures that the type of relationship obtained is very much a function of the method used. In Figure 57, a considerable discrepancy will be noted between the ascending and descending methods, with the ascending method leading to gross overestimation at all points while the descending method leads to far less overestimation. This is the procedure usually utilized in current Muller-Lyer tasks. No relationships

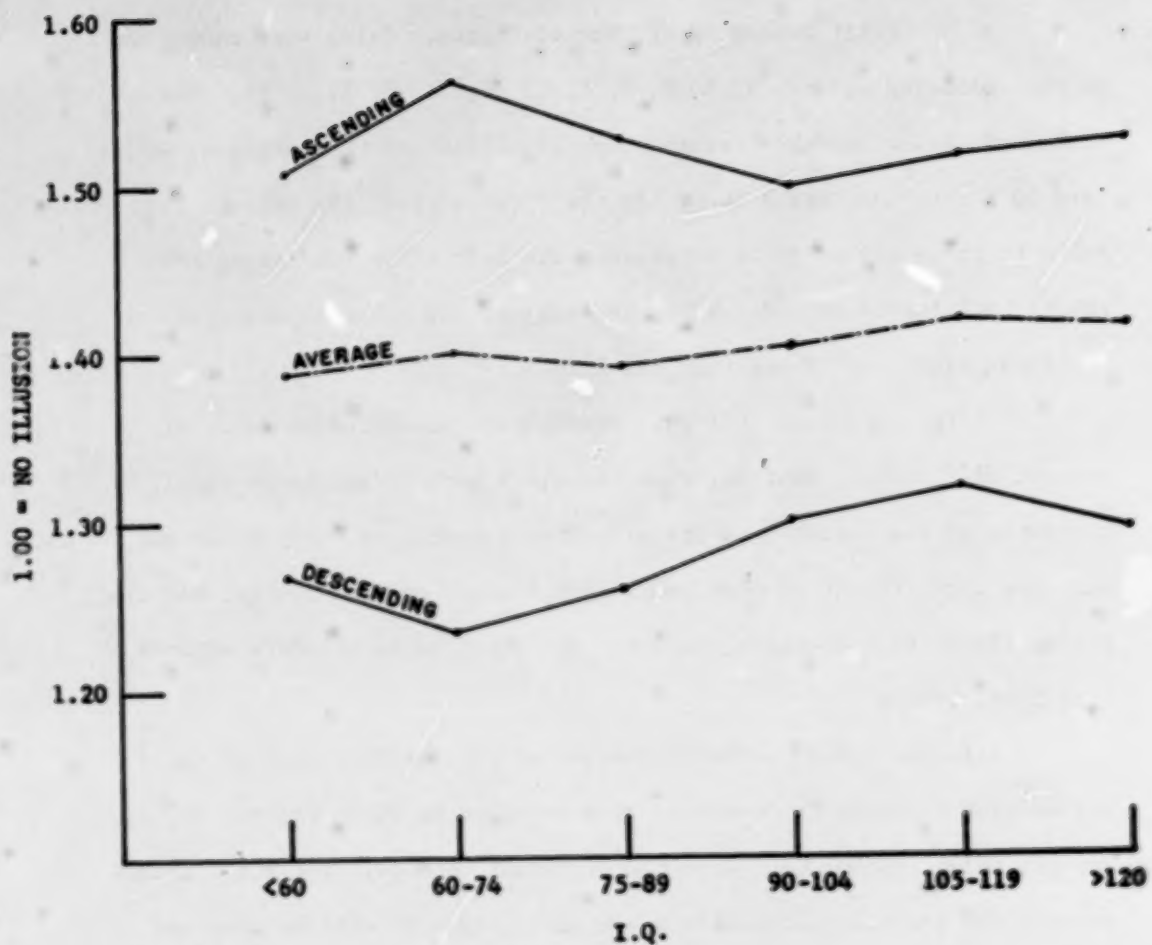


Figure 57.

Müller-Lyer Illusion and I.Q.: Equality-serial method (noninstitutionalized).

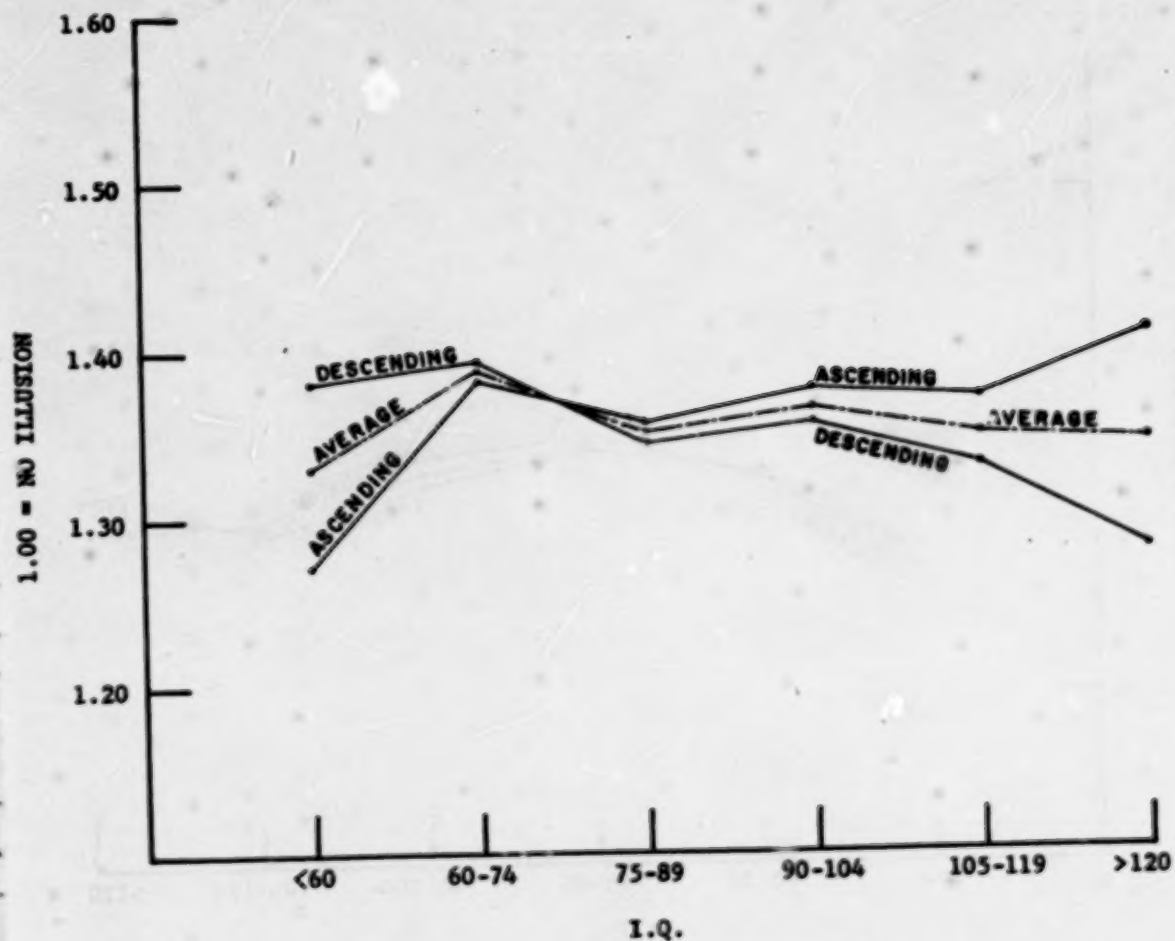


Figure 58.

Müller-Lyer Illusion and I.Q.: Forced-Choice-serial method (noninstitutionalized).

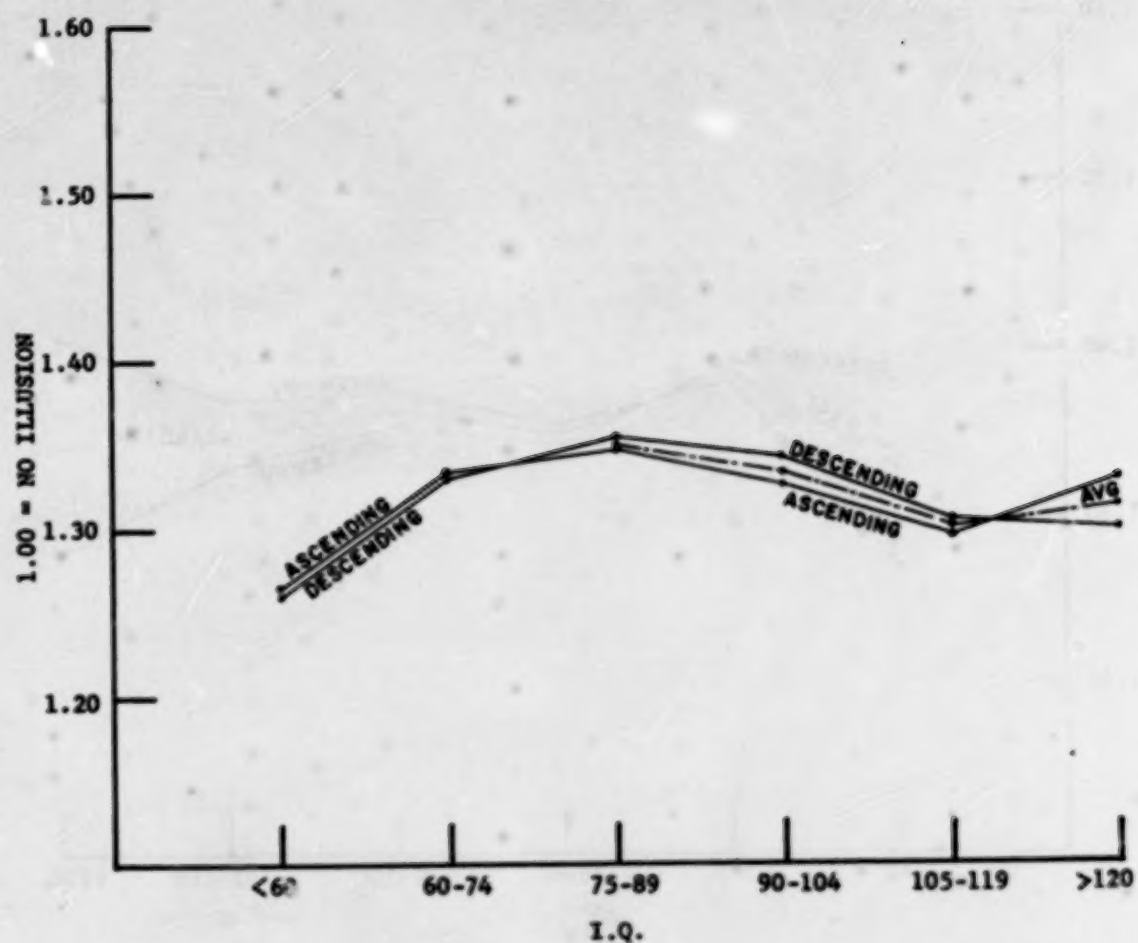


Figure 59.

Müller-Lyer Illusion and I.Q.: Forced-Choice-random method (noninstitutionalized).

with intelligence are readily apparent from this curve. Figure 58 presents results using the forced-choice serial method, which produces less range between ascending and descending methods than the serial equality method. It will also be noted that the average also tends to be lower. The random procedure is presented in Figure 59 and indicates very little difference between descending and ascending procedure with considerable overlapping. The means of the three procedures are compared in Figure 60. There is a relationship between means and spreads of the procedures; the procedure having the least differences between ascending and descending also produces the lowest average, while the procedure involving the greatest difference between the two also produces the greater average. It will be noted that there is no apparent relationship between the illusion and IQ. Similar results are apparent from corresponding curves for institutionalized subjects, presented in Figure 61.

(11) Relationship with Age: Normal Subjects. Relationship between illusion and chronological age is presented for normal subjects for the three methods in Figures 62, 63, and 64. Figure 62 presents the curves for the equality procedure. The ascending-descending relationships previously found for IQ are also evident here. There is a tremendous discrepancy between overestimation using the ascending method and the descending method. It will be noted that the descending method, which produces the least illusion, seems also to be independent of age, but illusion under ascending conditions seems to be related to age, producing an average which seems to follow an age relationship. Results using the serial forced-choice method are presented in Figure 63 in which the relationship with age is more apparent. It will be noted that the illusion is smaller and that the range is also smaller than it

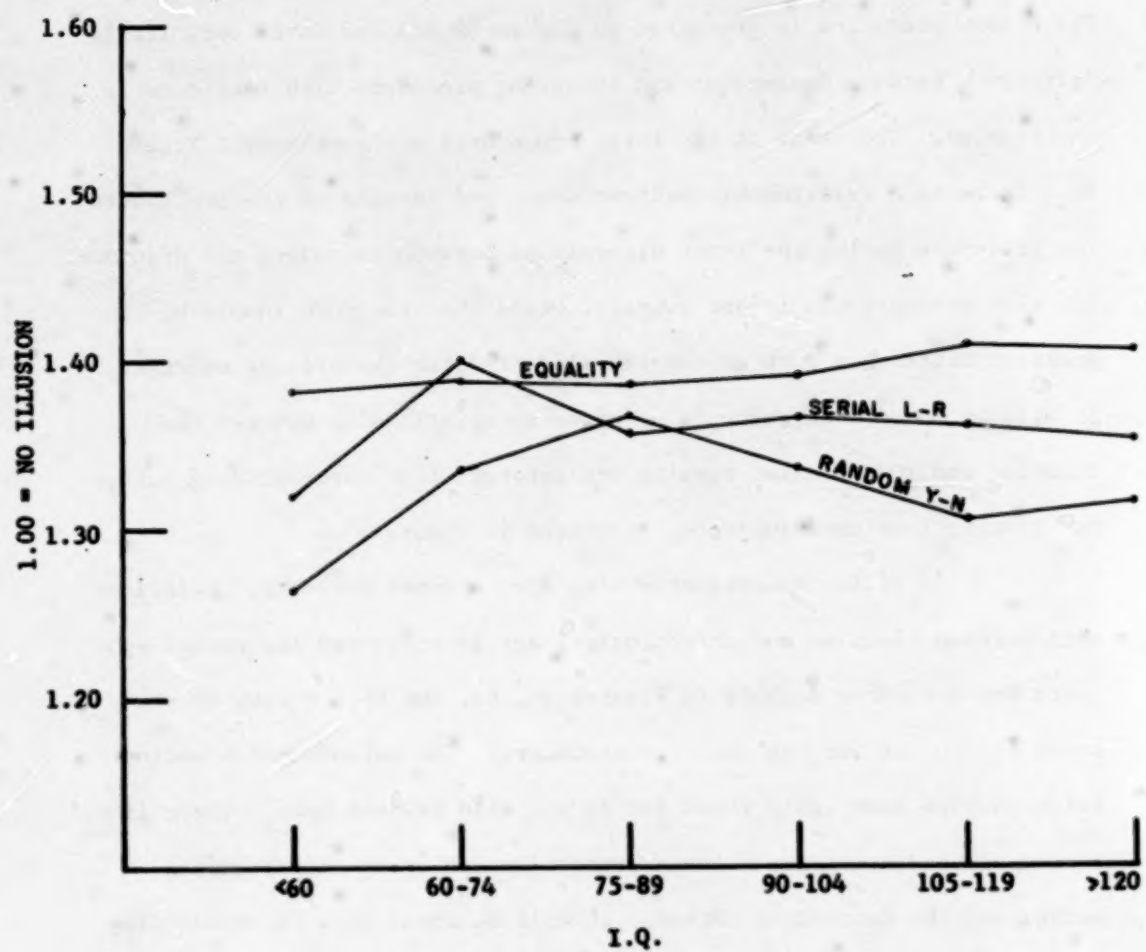


Figure 60.

Müller-Lyer Illusion and I.Q.: Averages for three methods (noninstitutionalized).

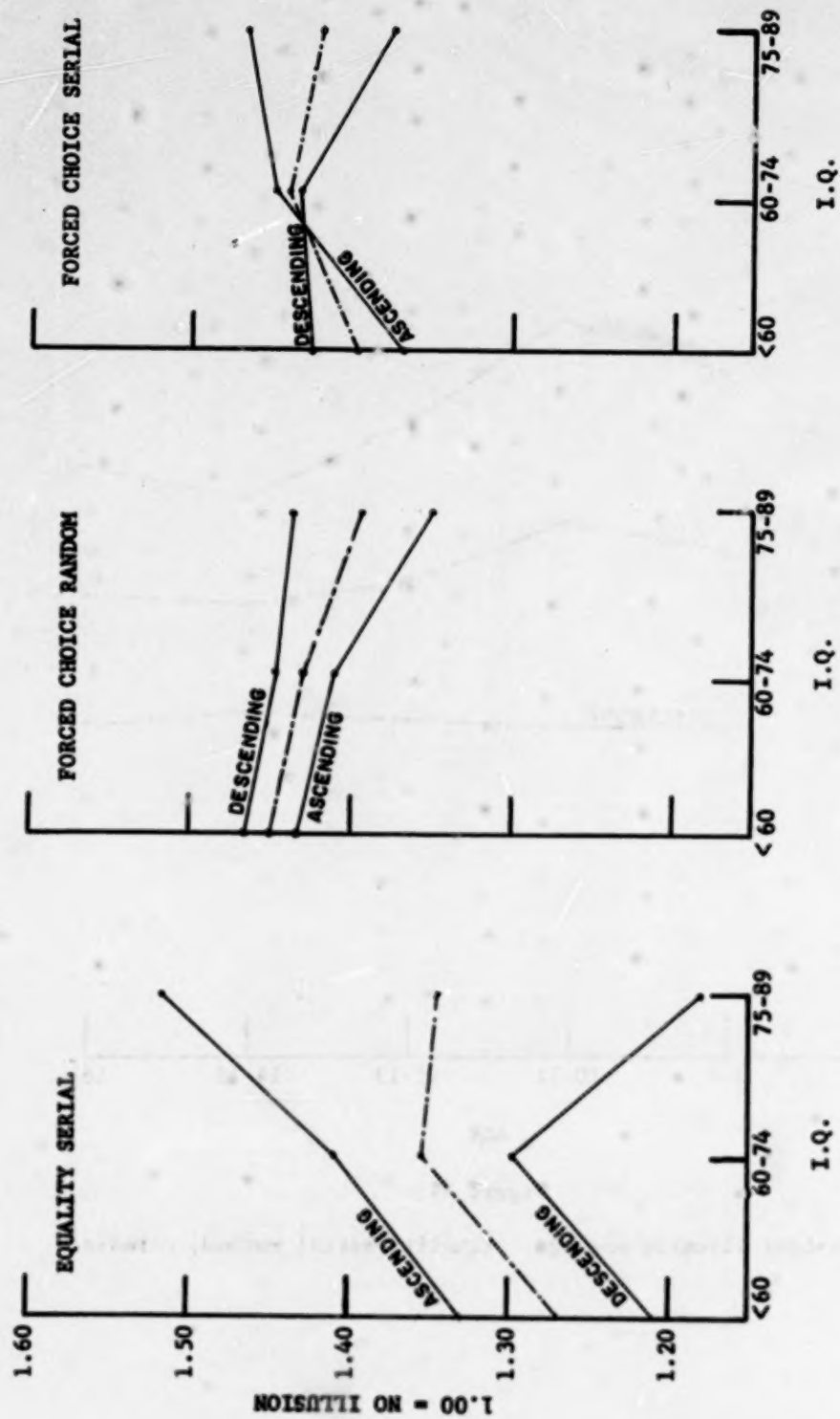


Figure 61

Muller-Lyer Illusion and I.Q. : Three methods, institutionalized.

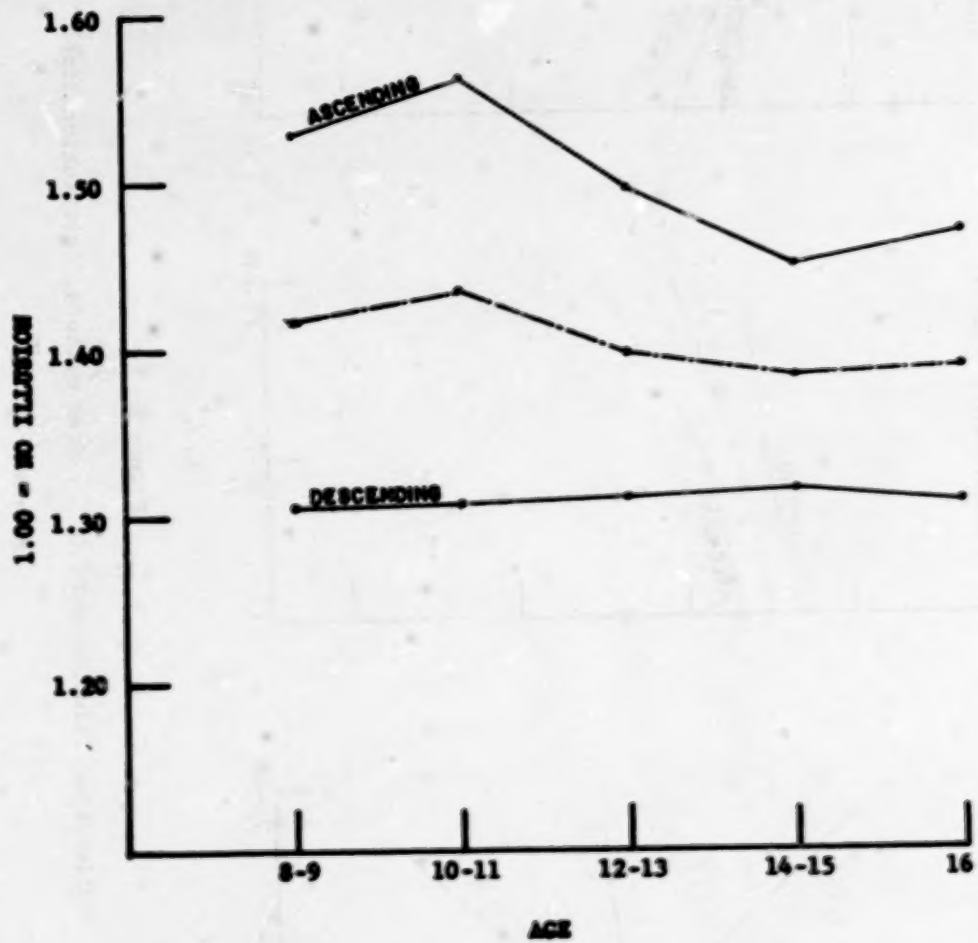


Figure 62.

Müller-Lyer Illusion and age: Equality-serial method, normals.

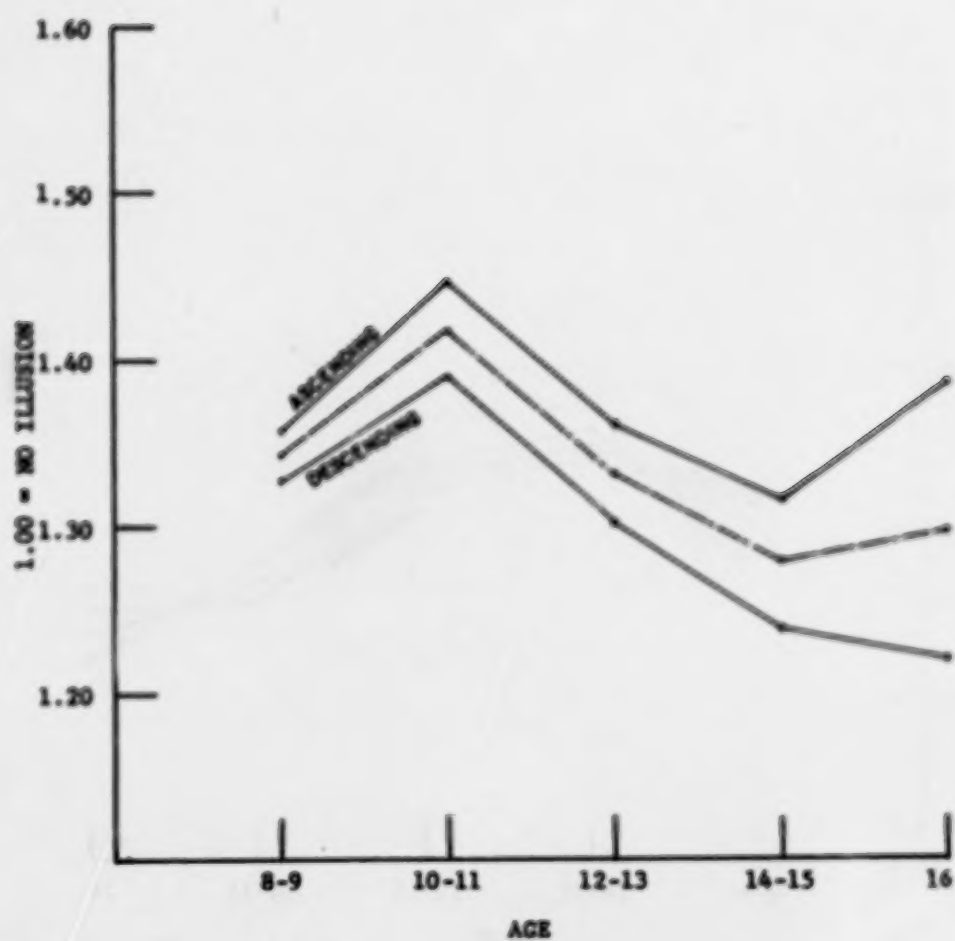


Figure 63.

Müller-Lyer Illusion and age: Forced-Choice-serial method, normals.

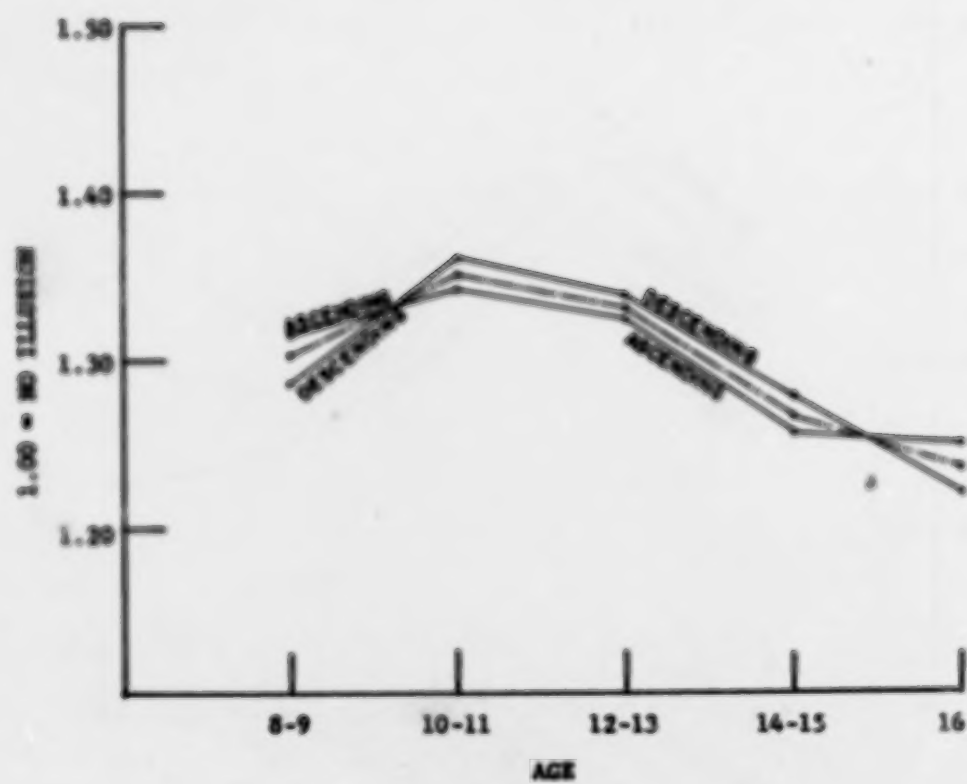


Figure 64.

Muller-Lyer Illusion and age: Forced-Choice, random method, normals.

was in the preceding method. Curves using the random forced-choice method are presented in Figure 64 with the age relation again evident; the average is lower and the range between the two curves has become so small as to make the two curves indistinguishable.

(iii) EM groups. Corresponding curves for subjects from the EM groups are presented in Figures 65, 66, and 67. The equality serial method is presented in Figure 65 and indicates that the discrepancy between ascending and descending procedures noted in the preceding curves is indeed a huge one. The retarded subjects display far greater differences between these two curves than do the normal subjects. On the basis of reaction time differences found, such should be the case, with the ascending curve being higher than in the normal subjects and the descending curves being lower than in the normal subjects. The average curves of the two groups overlap. In Figure 66, the different relationships found between methods for the normal subjects are not as apparent, although the same general relationships seem to hold. The relationship of age to IQ is not as evident here as it was for the normal subjects, though there seems to be a trend to drop with age. Figure 67 presents the random forced-choice curves. These are similar to those found for the normals, with the relationship again seeming to be blurred.

(iv) Institutionalized Subjects. Curves for institutionalized subjects are presented in Figure 68. The similarities between these curves and those for the other groups need not be elaborated.

2. Titchener Circles Illusion. The Titchener Circles illusion consisted of 17 cards, each of which contained two sets of circles. In one set, a series of small circles surround a larger one, and in the other set, a group of large circles surround a smaller one. The sizes

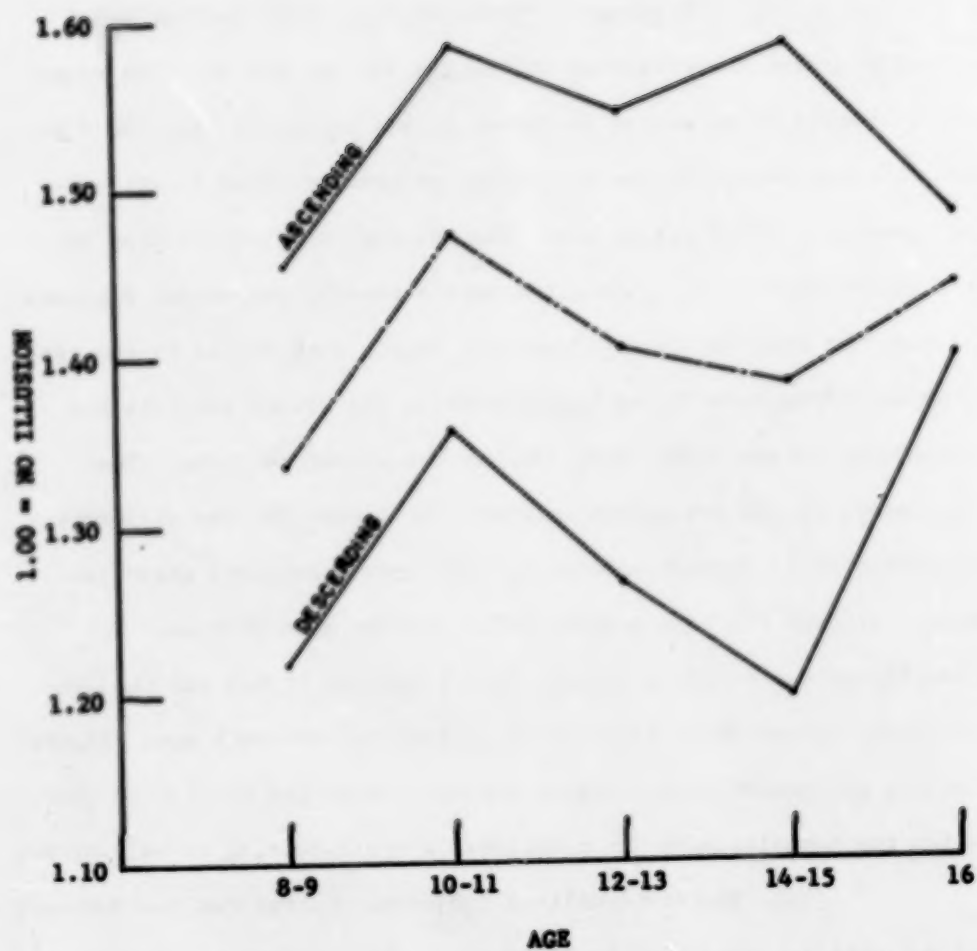


Figure 65.

Muller-Lyer Illusion and age: Equality-serial method, E.M.H.

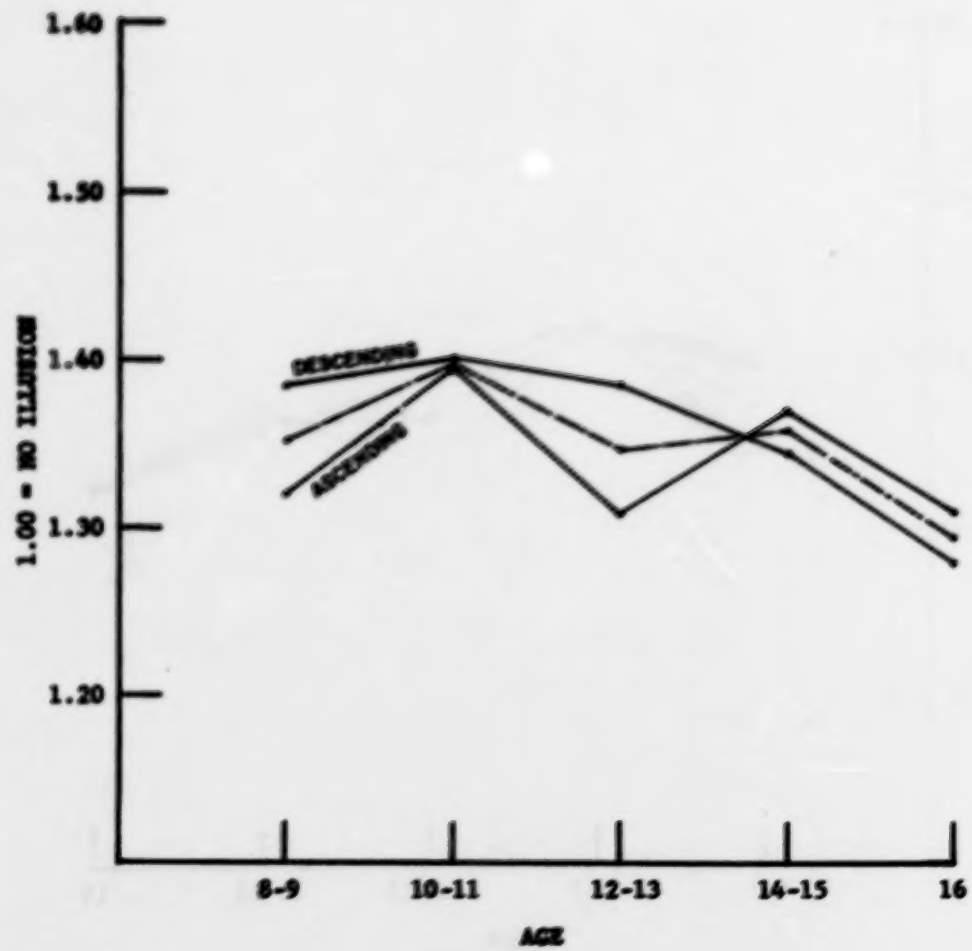


Figure 66.

Müller-Lyer Illusion and age: Forced-Choice-serial method, E.M.H.

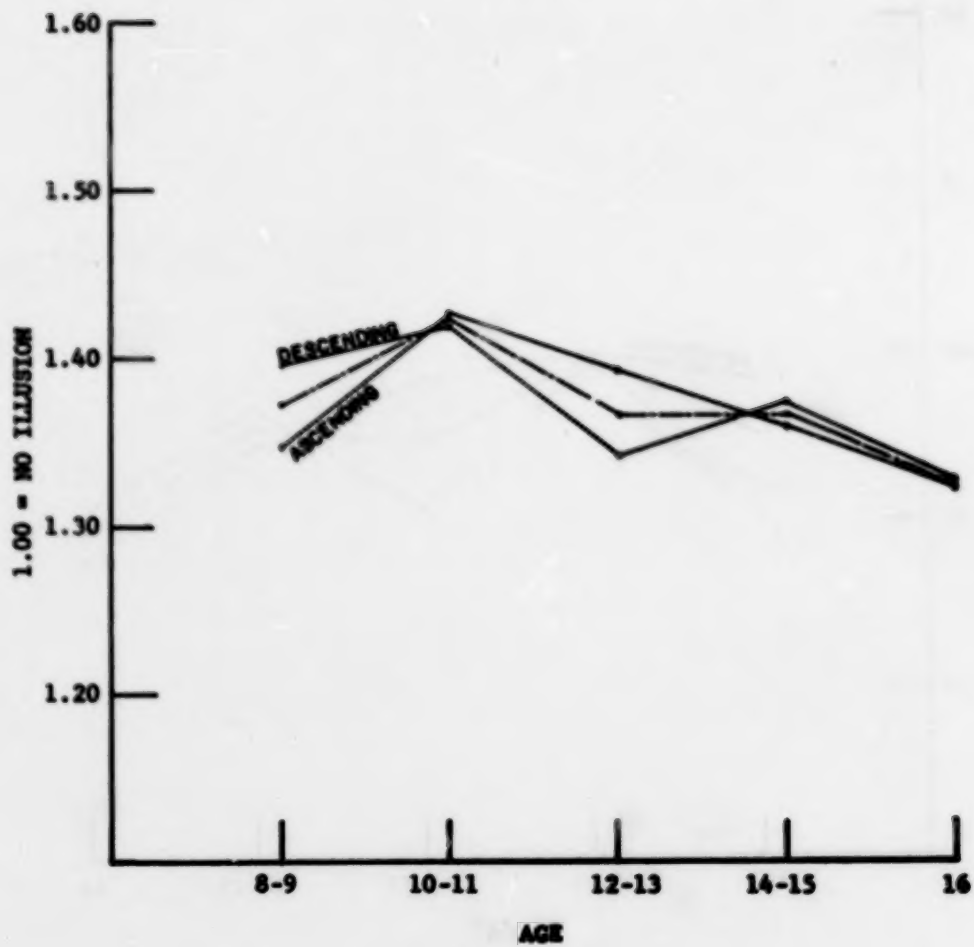


Figure 67.

Muller-Lyer Illusion and age: Forced-Choice, random method, E.M.H.

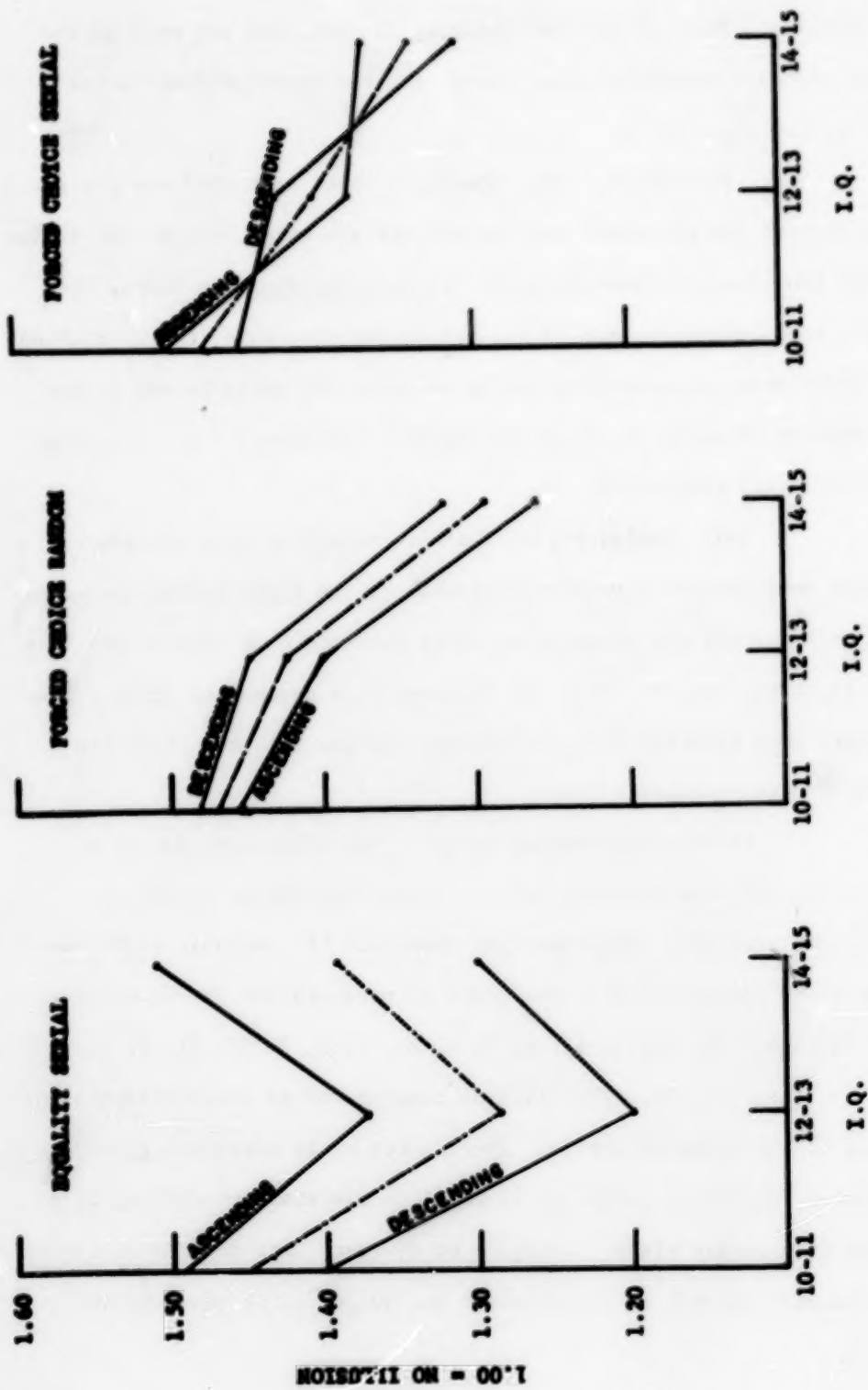


Figure 68.

Muller-Lyer Illusion and age: Three methods, I.M.H.

of all circles were constant except the one which was surrounded by the small circles. This circle kept changing in size, and the task of the subject involved comparing this circle with the corresponding center circle in the other group.

(a) Procedures. (i) Equality. Here each card was presented to the subject one at a time and the subject was asked to stop the series when the two circles appeared equal. In the ascending procedure, the variable kept increasing and in the descending procedure it kept decreasing. There were two ascending series in which the variable was on the left, and two in which it was on the right. There were four descending series similarly subdivided.

(ii) Serial Forced Choice. Following this procedure, the cards were presented with the variable on the right in the ascending order, with the subject required to state for each card whether the left or the right was larger. This was followed by a descending series. The cards were then reversed with the variable on the left and these two procedures were repeated.

(iii) Random Forced Choice. The cards were put in a random order with the subject required to indicate which circle was larger, left or right. This was done once with the variable right, and then with the variable left. The order of presentation for each series was as follows: 12, 10, 4, 17, 9, 2, 3, 13, 1, 8, 7, 14, 11, 6, 16, 15, 5.

(b) Results. The illusion consists of an underestimation of the size of the standard circle. The figures to be presented represent the size of the circle judged to be equal to the standard circle, as a function of diameter sizes. A figure of 90 means that a variable circle whose diameter was 90% of the standard was judged to be equal to the

standard. Accordingly, in the curves which follow, curves whose percentage progressively drops (negative slopes) represent an increase in the illusion, whereas, curves which rise represent a decrease in the illusion.

(i) Equality-Age. Judgments of equality as a function of age are presented for normal and retarded subjects in Figure 69. The same tremendous gaps between descending and ascending series that characterized this type of judgment in the Muller-Lyer illusion are found to be operative here. It will be noted that the descending series is higher than the ascending, that is, it produces a lesser illusion. In the Muller-Lyer illusion, the descending series also produced less of an illusion, although this was reflected by a curve producing lower scores than the ascending curves. Again, when normal subjects are compared with retarded subjects, the retarded subjects display a far greater range for each age than do the normal subjects. Institutionalized children are within the range of the other retarded groups. For normal subjects, there seems to be a slight increase of the illusion with age (if the first year group is omitted). For the retarded subjects, slope of the curve is not apparent.

(ii) Serial and Random Curves. Serial curves in which the ascending curves for variables right and left are averaged, and the descending curves for which variables right and left are also averaged, are presented in Figure 70, with the average random curve beneath them. As was noted with the Muller-Lyer illusion, the range between the ascending and descending curves diminishes markedly with considerable overlapping. The random curve produces the lowest scores, which in this case involves the most illusion. If there is any relationship with age, it

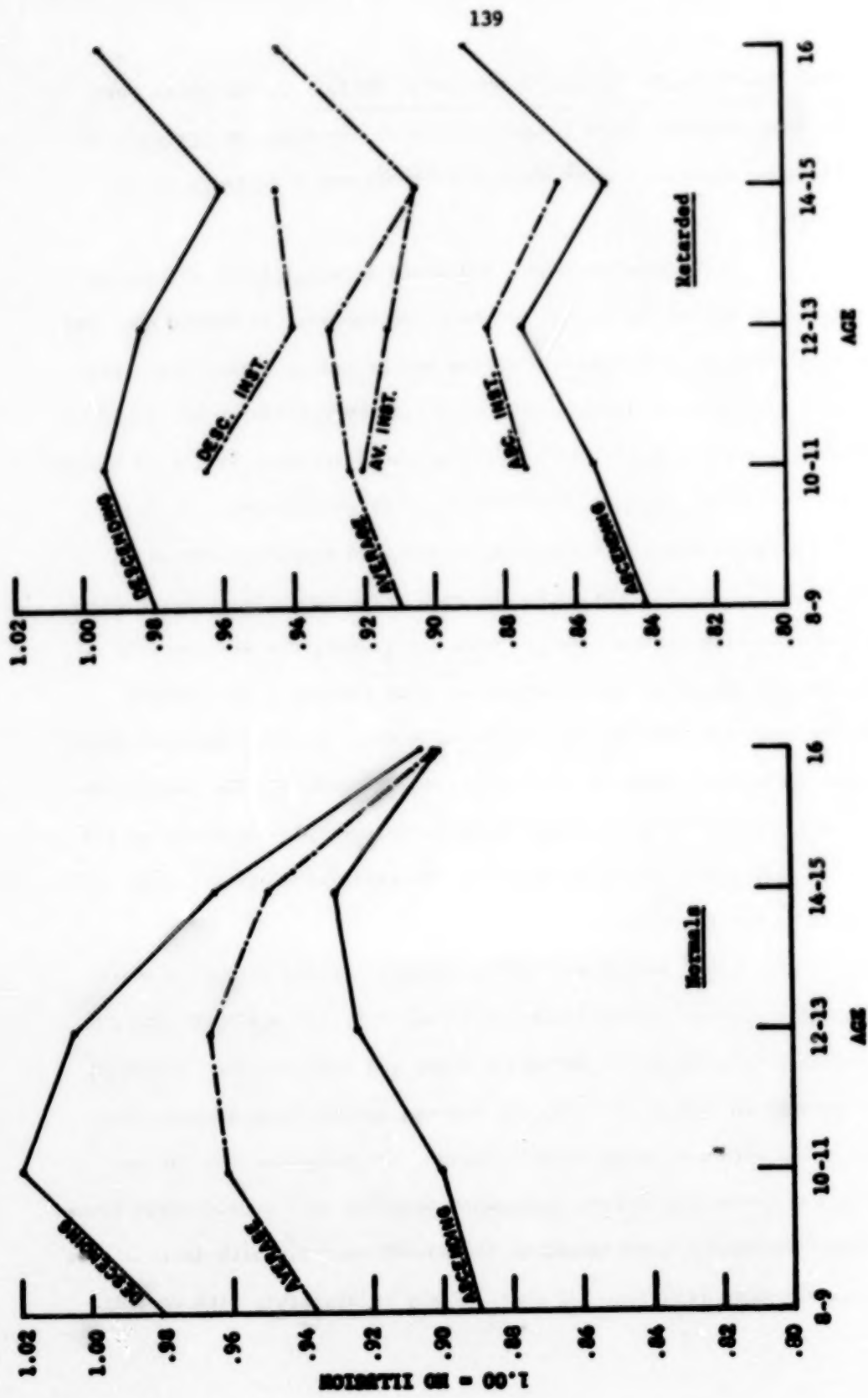


Figure 69.

Titchener Circles Illusion and age: Serial Equality method, all groups.

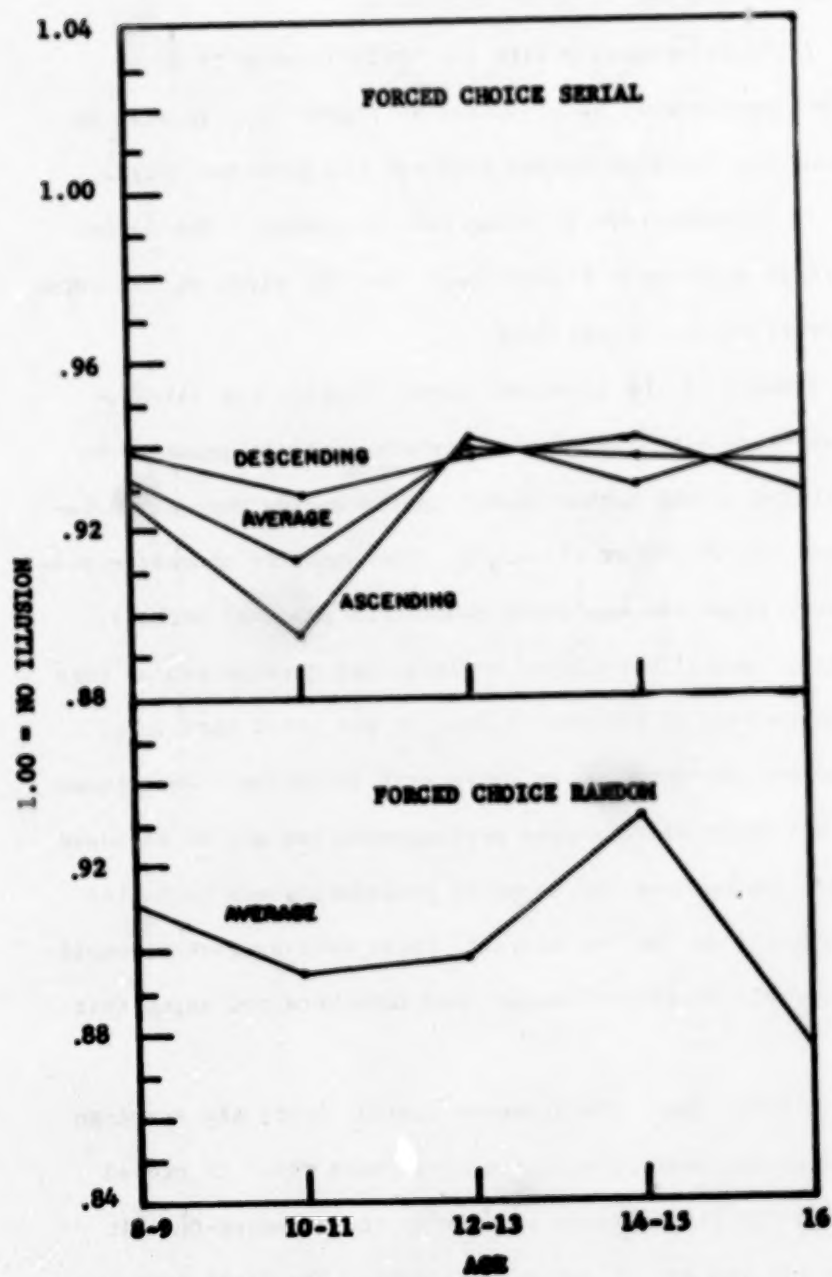


Figure 70.

Titchener Circles Illusion and age: Forced Choice methods, normals.

seems to be one in which the illusion decreases.

(iii) Relationship with IQ. Relationship of IQ to Titchener Circles performance is presented in Figure 71. It will be noted that again, the equality method produces the greatest range. Illusion seems to decrease with IQ using this procedure. The serial forced choice again produces a lesser range, and the slope of the curve can not be ascertained from these data.

3. Summary of the Illusions Data. Whether the illusion increases or decreases with age or intelligence quotient seems to be very much a function of the method used. Consistencies were noted between Muller-Lyer and Titchener illusions. The equality procedure produced the greatest range and the other procedures produced markedly diminished ranges. Mentally retarded children had greater ranges than normals. In discussions of previous tests, it was noted that large ranges characterized introduction of extraneous variables. What these variables are, and their effects upon performance, can not be assessed from these data. Inasmuch as the equality procedure seems to be the standard one currently in use for testing, these data suggest reconsideration of perceptual conclusions drawn from data obtained using this method.

D. Other Tests Run. The Streeter-Gestalt test, the American Optical Sight Screener, and color vision tests were run. It proved extremely difficult to get subjects to work at the Streeter-Gestalt figures, and the results are of dubious validity. The Sight Screener yielded results which were unreliable, that is, subjects reported inability to read letters in one cluster of letters but were able to read letters in clusters requiring greater acuity. In actual practice, tests

TITCHENER CIRCLES ILLUSION AS A FUNCTION OF INTELLIGENCE QUOTIENT AND METHOD OF PRESENTATION

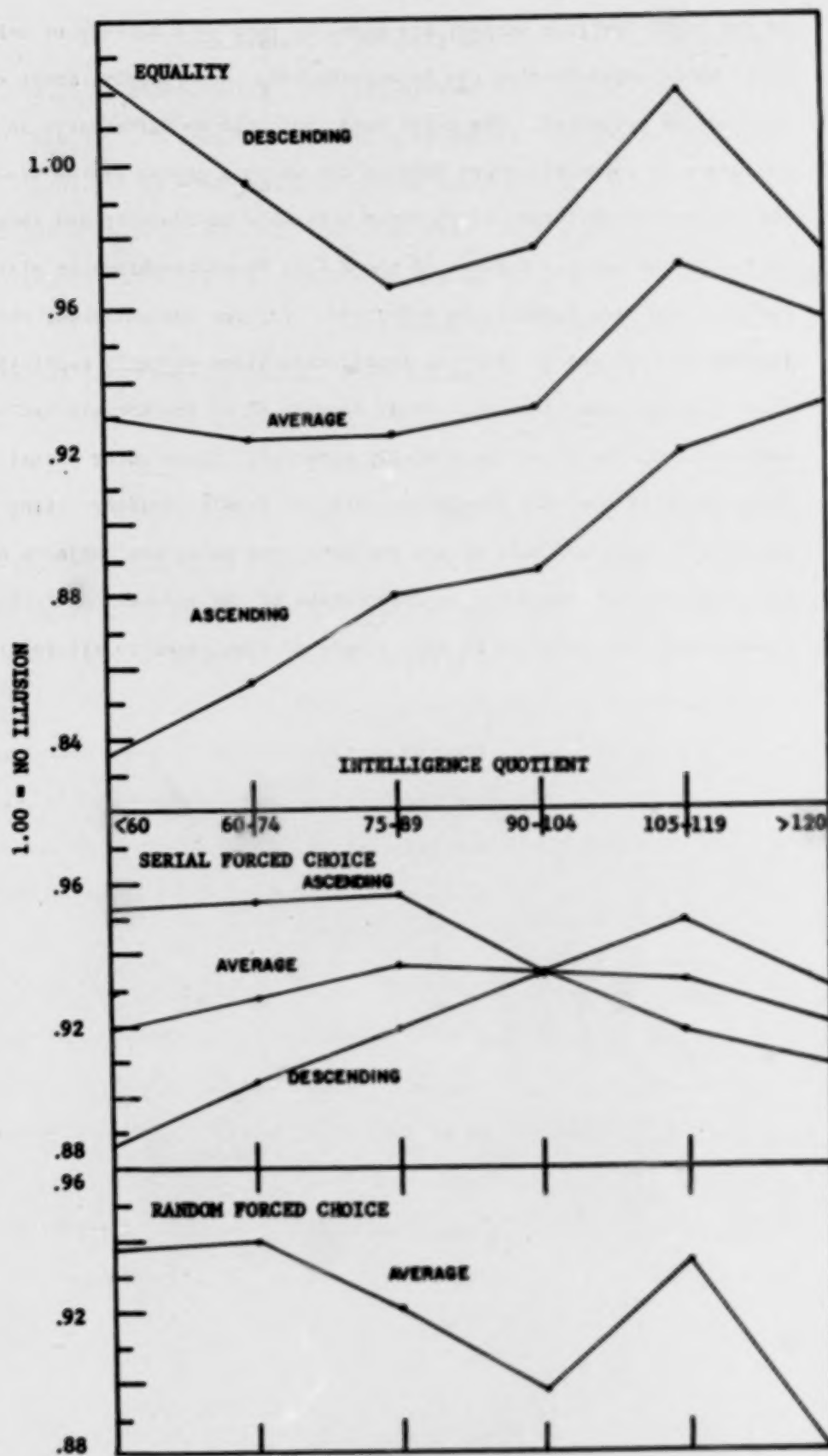


Figure 71.

of the Sight Screener variety are given as part of a battery of other tests where consistencies can be ascertained. Accordingly, these data will not be presented. The color data indicated no differences in incidence of color blindness between the various groups of the study. For the normal children, 47 children were able to identify and locate correctly the various figures of the H.R.H. Pseudoisochromatic plates, and only two were found to be defective. For the EMH children, these figures were 40 and 4. For the institutionalized mentally handicapped, these figures were 51 and 0. Thus, roughly 4% of the normals had color deficiencies, and 4% of the mentally retarded. Since color anomalies occur in 8% of the male population with the female incidence being practically nil, and half of the subjects were male, the subjects of the study can be considered representative of the general population. These tests were found to be very simple to administer to all populations



CHAPTER V

COLLATION AND IMPLICATIONS FOR EDUCATIONAL PRACTICE AND RESEARCH

The rationale underlying the methodology of this study was that the perceptual response is a member of that class of responses known as verbal responses¹, and is subject to control by all the variables that control verbal responses in general. That it has a semantic reference to perception in no way exonerates it from such control. Accordingly, the problem of relating change in the response to perceptual change rather than change in other relations, becomes more than academic, and must be based on something more than faith in the subject, and belief that he is not lying, no matter what other evidence is available to this effect. The subject may be convinced that he is telling the truth, but if his perceptual responses are manipulable by the experimenter, it is obvious that the latter has better control and prediction over the response, and accordingly, better understanding than the subject. Fundamentally, the problem reduces to one of methodology, and no conclusions regarding perception can in this sense, transcend the methodology employed.

In the study reported, the basic involved the occasioning of a variety of responses for the same stimulus presentations. This procedure stemmed from an implication drawn from consideration of the perceptual

¹A verbal response, as used here, is to be distinguished from a vocal response, the latter representing sounds involving vocal cords, the former including written responses, button push responses replacing verbalizations of Up, Down, Yes, No types, as well as verbalizations.

response as a unit of verbal behavior. The implication referred to is that differing verbal responses have different histories of control by the environment. Conversational speech differs from academic lecture speech. Even in conversational speech, certain words are, for example, used with one audience, rather than with another. Accordingly, two different verbal responses occasioned by the same stimulus presentation may be differentiated by the effects of differing histories. They will have in common some similarities in history, and the same stimulus presentation to occasion them. Providing the conditions are proper, differences in responses obtained under such conditions may be related to differences in nonperceptual variables, but the inference is not as simple for similarities obtained between such responses. The proper conditions of a perceptual experiment involve methodological considerations, and relationships to other data, which can not be considered in this discussion. The attempt was made in this study to convert the rationale given into the methods of the study reported.

This study was also characterized by the use of certain procedures normally not employed for children, and especially not with mentally retarded children. Among these were psychophysical tasks involving absolute and size discrimination. Psychophysical tasks (as distinguished from perceptual tasks) are normally used only for highly trained adults.

It would seem possible, from the data of this study, to make several tentative conclusions. Among these tentative conclusions is that the stimulus energy value at which a given stimulus can be accurately localized is independent of IQ, but is an inverse function of age. The older the child, the less energy value needed. This may relate to developmental factors such as the increase in near-point vision

as a function of age; the screen was at a considerable distance from the subjects. Reaction time seemed also to be related to age, as well as to IQ. With regard to size constancy, which has been considered as related to age, developmental relations were noted, but the question was raised as to the extent to which these represented size constancy, or response variables such as serial effect, reaction time, overestimation, and the like, that is, increase in stimulus control over the response as a function of age. Data collected with the methods used could support no conclusions regarding the nature of the effects in the illusion studies.

A consistent pattern arose in several of the tasks which was relatable to both chronological age and IQ. This involved the tendency of younger subjects, and especially mentally retarded subjects, to respond in a manner which can be subsumed under terms such as overestimation, exaggeration, or the like. In the psychophysical tasks, both retarded subjects and younger children tended to make almost exclusive use of the 2 response for Yes. It may be argued that their use of the 1 response was related to training for a novel response, that is, people are not often asked merely to indicate a difference; it may also be argued that the more definite class of responses (represented by 2) is more frequent, and hence requires less training. However, they also reported seeing the stimulus at intensities where their accuracy was no better than chance. Further, there was also an accompanying tendency to produce "false alarms", that is, the same subjects who used the more definite responses also reported seeing the stimulus in locations in which it was not presented. Such behavior has a variety of clinical connotations, such as "hallucinations", "seeing things", and the like,

all of which are pejorative in our society. Indeed, there is experimental evidence to indicate that reports of seeing drop when adult subjects are told how well they have done in locating a figure after each pair of responses. To locate a figure in the wrong position when the lights are dim is not fraught with aversive consequences, especially when the subject states he has not seen it. But to state one has seen the stimulus, and then to locate it in the wrong position, does have an aversive history attached to it. Hence, merely telling the subject that his location was right or wrong can depress reports of seeing as compared to subjects not supplied with such information (Goldiamond, 1954). It may, in the long run, increase accuracy of location (Blackwell, 1952), but this is independent of its effects on Yes-No responses. Mathematical functions have been drawn related to explicit manipulation of consequences in decision theory (Tanner and Swets, 1954). "When in doubt, leave it out" is a maxim supported by the controlling consequences which our society places upon such behaviors. Examining the psychophysical data of this study indicates that at the lowest age tested, children from the different groups started out using the same number of 2 responses. The groups then became differentiated as a function of age. The retarded subjects continued to give about the same number of 2 responses, and also gave false alarms, while with each increase in age for the normal subjects, there was a drop in number of 2 responses used. There was also a general diminution of false alarms. Further data bearing on overestimation are found in the size-constancy study. If delayed reaction time for the retarded groups was the major variable involved in differences between normal and retarded subjects, then the ascending curves would have been higher for the retarded groups than for the normals,

which they were, while the descending curves would have produced matches at smaller variable settings, which they did not. Both procedures produced higher curves, suggesting a persistent overestimation by the retarded children. The retarded subjects tended to report the triangles as larger than the normals did, they tended to report seeing the locational figure in positions in which it was absent more often than the normals did, they tended to report seeing it at intensities too low for localization, they tended to assign more assertive numbers to their report of vision than did the normals, who performed in similar manner at early ages, but gradually dropped these behaviors as a function of age or remained at a minimal level throughout, as in certain size constancy cases under appropriate conditions. Interestingly, the retarded subjects tended to localize the figures at energy levels which decreased with age, that is, would have improved as a function of age had energy levels been held constant, in a manner very similar to that of the normals. In short, these data suggest that where response variables such as effects of consequences, reaction time, serial effect, and the like, can affect the perceptual response, the retarded children tend to behave in a manner similar to their performance on IQ tests, that is, in ways characteristic of average children younger than they are (cf. Kolstoe, 1952). Where such are excluded from the perceptual response, this may not be the case, as was evident in the essential similarity of zeroing-in curves.

The clinical and education literature on behavior of the mentally retarded is in agreement with the observations about laboratory behavior made in this study. For example, Wallin and Kolstoe report that "there seems to be agreement that the mentally retarded generally ... (have)

specific, concrete reactions. Value judgments tend to be absolute" (1959, p. 134).

Developmental data were considered one source of material for generalizations about performance by children of differing IQ. In the studies conducted, it was noted that different curves were obtained by utilization of differing psychophysical methods (ascending, descending; scrambled, ordered), psychophysical indicators (equality, left-right; 210, Up, down, left, right), perceptual variables (direct vision, mirror vision). Much of the literature relating development and perception is based upon the identification of perception with an exclusive combination of these variables. When different combination were employed, the results hitherto obtained, and ascribed to perception, were not obtained in many cases. This may suggest some reopening of the perceptual implication of these studies. What may be involved is the covariation of the extraneous variables with development; on the other hand, perhaps perception is involved. The data presented suggest that a possibly more fruitful approach may be an experimental analysis of the perceptual situation to investigate and isolate the variables which function in such experiments, and to relate these to the developmental problems on hand. Such isolation of variables has, needless to say, been the task of psychophysical laboratories since their inception. This methodology has generally not been applied to developmental problems. More typically, it has been the more complex tasks, such as Streeter-Gestalt, illusions, hidden figures, and the like which have been used, as in Raven's Progressive Matrices. These tasks are characterized by their greater simplicity of presentation, when contrasted with the classical psychophysical tasks; by their greater simplicity in equipmentation,

requiring pencil and paper instead of "brass instruments." On the other hand, the psychophysical tasks are characterized by their greater stimulus specifiability--a light of so many footcandles, against such a screen, and so on, in contrast to the extremely complex figures of the "perceptual" tests. The case being presented for the stimulus simplicity found in psychophysical tasks is not based on some mystical aesthetic appeal, but upon the fact that through the use of tasks involving stimuli of such specifiability, the psychophysics laboratory has been enabled to establish functional relations between specifiable response measures, $S = .K \log R$ being an example. In investigating these relations, considerable attention has been directed to development of methodology. Given such predictable relations, alterations in curves obtained can be traced to witting or unwitting alterations in procedures, and variables can thereby be isolated. Such is not the case to as great an extent in the other tasks discussed, since the specification of stimulus necessary for establishment of functional relations is often difficult. Accordingly, it then becomes difficult to interpret, in terms of operating variables, data of the second type, once obtained. The psychophysical data, on the other hand, are more readily amenable to such interpretation. Further, with regard to the developmental problems on hand, they suggest themselves as an approach to developmental problems which may yield information of some value in this area. To date, they have been characterized by their relative absence in this area.

It was also noted that it took a great deal more time and effort on the part of the experimenters to get data from the retarded children than it did from the normal children. To get the retarded children to respond, two experimenters were often necessary, one to continue prompting

the child, and another to operate the controls. When responses were obtained, however, they tended to fall into the patterns indicated. This time element raises certain procedural issues for experimentation, but our present concern will be with the procedural resolutions of such behaviors in educational practice, and their possible relation to the overestimation performances noted.

In educational practice, the issue of "slowness" has been settled, in certain communities, at least, including those of this study, by segregating the mentally retarded children. Such segregation can be effected by special classes in regular schools, such as the EMH classes, or by special institutions, such as that at Lincoln, Illinois. For normal children, this has the obvious advantage in that the classroom average is thereby raised, and the "average" child can be taught more rapidly, and presumably with the creation of less boredom. For the retarded child, an advantage is that the learning can be slowed to his pace, and his learning is not sacrificed to the higher average of a normal class. This seems to be an ideal solution, since it has been suggested that retarded children can learn many school subjects as well as normal children, but cannot compete with them, (cf. Larr, 1956), that is, it takes more time for them to learn. They are "slow" or "dull".

One possible disadvantage of such segregation may be suggested by the data of this study. Certain concomitants of this practice, to be discussed shortly, may relate to the presence of overestimative responses in younger children, their gradual elimination as a function of age in normal children, but the perseveration of these responses in retarded children, with consequences attendant upon the perceptual response. If the normal child is becoming more cautious and more precise,

whence this increase in precision? It may not be purely a function of growth, since where growth enters into the response, as it possibly does in energy levels for accuracy, retarded children also change. We may speculate that conceivably what is involved may be related to what is called "socialization". Segments of our society demand precision in certain verbal behaviors, that is, discriminative responses of the overestimative kind tend not to be reinforced, or may be followed by aversive consequences, and accordingly, tend to diminish the longer these consequences are applied, that is, as the child grows older. It was a mother who informed her child; "I've told you a million times not to exaggerate." If such responses do not diminish with the mentally retarded, one might speculate that such consequences are not being applied. Indeed, the very nature of much training of teachers and parents for special work with the mentally handicapped suggests this. Understanding and accepting behaviors are often stressed. This may be necessary to continue verbal behaviors by the retarded at a high level (which they might otherwise not be), but nevertheless, this amounts to the application of different consequences to overestimative behaviors of retarded as opposed to normal children. At home, such different consequences may be applied by parents and possibly other children. This is a behavioral segregation suggested by statements that such children should be treated differently, that is, with "greater understanding." The segregation may be a physical one through the medium of EMH classes, or institutions for the mentally retarded. Segregation in and of itself may not be involved; what may be involved may be termed a "permissive" concomitant of segregation, which acts to supply consequences to overestimative behaviors of retarded children which differ from those applied to such behaviors in normals.

None of the foregoing should be interpreted as an inhuman plea to get tough with these children. The arguments are presented in terms of a possible relation to the overestimative behaviors found in this study. The retarded child may be considered by the teacher as lacking in critical ability; overestimative behaviors by the child are then "accepted", they continue with high probability, thereby reinforcing those stereotype behaviors of the teacher relating to lack of critical ability in retardates, with further "acceptance" and noncorrection of overestimation, and so on, a chain noted by sociologists in studies of prejudice. One wonders how many other such attributes assigned to the mentally retarded are self-perpetuating in a similar way.

If the mentally retarded child is at an educational disadvantage in a classroom geared to the average child, then so, too, is the bright child, as has been acknowledged by those educators proposing special classes. It is probably a rare child who is average in all respects and who therefore completely escapes the disadvantages of treatment geared to the average. A solution met in some private schools is to approach the ideal of a separate teacher for each child. This is often the case in remedial training in public schools. This has the practical advantage of instruction related to the child's own rate of learning. The attendant economic difficulties need not be elaborated. Not only are more teachers involved, but the teachers themselves require special training; they must go at one rate with one child and another with yet another. Further, where the child is slow, considerable patience and "emotional stability" are required. Hence, the solution often found is a collection of similar students under a teacher specialized in these problems; this can be considered a lesson from the mass production

processes of industry. A lesson from the rationalization of production which might seriously be considered as an alternative, and which does not have the disadvantages cited, might involve the utilization of a teaching machine for each child as an aid to the teacher. Such machines are individualized, that is, they run according to the pace set by the individual learner. The machine has all the patience in the world for the slow learner. Further, the odds are against its building up of the self-realizing stereotypes about the retarded child noted for some teachers. Aided by such machines, the teacher involved need not be specialized; she may encourage one child to start work on the lessons in one way, and another in a different way. Under such an arrangement, mentally retarded children need not be segregated in a special way that distinguishes them from normals. What is needed for the quick child are advanced programs to insert into the machine. Accordingly, it would seem that some of the educational considerations which lead to special segregation of the mentally retarded can be met by such teaching aids, without some of the attendant disadvantages of segregation that seemed present in the perceptual responses of the children of this study (cf. Skinner, 1958).

This study may have other implications for educational practices. In this study it was noted that two different elements in the reaction time responses related differently to the variables of the study. Traverse time dropped dramatically as a function of IQ. Had only the low IQ's been studied, it would have appeared that traverse time was far slower than lift time. The opposite turned out to be the case upon examination of other groups. Methodologically, this suggests the importance of observations based on more than a limited number of responses.

It also suggests the importance of experimental analysis of behaviors assumed to be units. This has implications for research and for generalization based upon research. It also has implications for training. K. U. Smith, in research concerning the industrial concept of the therblig, named after the industrial engineer (Gilbreth, name reversed) who analyzed industrial work into response units, has demonstrated that the response units in, for example, assembling radio parts, are not equal, nor are they equally amenable to training. Certain response units yield to training far more dramatically than others. The implications for training in educational skills for the mentally retarded (and other children) involve breaking down complex responses into constituent units and testing for training differences. Further research in this area is needed. Incidentally, the rationale for teaching machines provides for such a breakdown for subject matter, and for the possibility of a systematic analysis of the efficacy of the training units used.

For perceptual research with the mentally retarded there would seem to be further implications. It was noted that all children performed more poorly, and the retarded children especially so, in the psychophysical absolute discrimination tasks than in the size discrimination tasks. Absence of reference points was considered implicated in these differences, and the decrement in responses by the mentally retarded children was related to variables affecting perseveration of responses learned in the serving-in period, and utilized as perceptual indicators in the perceptual testing period. Response probability dropped off in the testing period. The upper asymptote was often not reached, and variability in the accuracy curves was higher than in normals. The

necessity for constant prompting of the retarded children was also noted. In regard to perceptual conclusions, this suggests that decrements in such performance by retarded children may be related to learning variables (including motivational variables), and it becomes the task of future research to develop further procedures to differentiate between perceptual and learning variables which can affect the perceptual response. In regard to perceptual research, this also suggests the importance of developing procedures which will insure automatic stimulus control of the response during the perceptual session, so that the response does not fall off. Procedures used in this study were obviously inadequate for absolute discrimination at least, making it difficult to make definitive conclusions. To what extent this entered into other sessions can not be ascertained. Procedures involving automatic stimulus control of response are currently being developed in operant conditioning laboratories with animals and humans (cf. Azrin, 1958), and it would seem that further research on the adaptation of these methods to mentally retarded children may yield dividends for research and application. For example, Blough (1957) has been able to obtain Yes-No curves of vision from a non-vocal animal such as the pigeon. Other experimenters have been able to supply, for the first time, a definitive answer as to whether birds have olfactory discrimination, using operant conditioning procedures (Michelson, 1959).

Such research of necessity requires a different approach from that used in this study, where certain procedures were attempted, pre-tested, and then committed for the duration of the experiment. These may provide analyzable data, as was the case in some of the procedures, or they may merely indicate that the problem is more complex than it

seems, as was the case in the illusions data, without specifying what underlies the sources of variation noted. An alternative method of approach involves the systematic alteration of procedures as the experiment progresses, in an attempt to find out what is responsible for the changes noted. These procedures involve long term analysis of a few subjects, under carefully controlled conditions, with the collection of large numbers of responses from each subject. When regularities of behavior emerge, effects of alterations in procedure can be readily assessed by analysis of deviations from response regularities.

These procedures are among the oldest in biological science. They are the procedures of the laboratory of physiological psychology, where statements about nerve conduction in general can be made from controlled manipulation of a single nerve, or of the visual psychological laboratory where one subject, who is colorblind in one eye, but not the other, becomes the subject of prolonged study (cf. Berger, Graham, Hsia, 1958). Such procedures were introduced into the field of learning by Pavlov's conditioning experiments, were extended by Thorndike, and have been further systematized in the area known as operant conditioning. Psychophysics has classically been characterized by the use of controlled laboratory conditions, few subjects, with the collection of large numbers of responses from each. The present study can be considered an exploratory study in the attempt to apply some of these procedures to the study of perceptual responses in children. A possible positive finding is that psychophysical curves can be obtained from mentally retarded children. Another finding may be the questions raised about data up to now considered definitive, such as certain relations between development and perception. These may be related to nonpercep-

tual variables which change with age as a function of consequences applied, and which affect perceptual responses. Methodologically, the application of paired operant responses to similar discriminative stimuli may provide further information. At the least, the study may suggest that the application of laboratory procedures more rigorous than those used here, especially those involved in the continual controlled change of conditions (experimentation in the tradition cited), may provide data and procedures which are applicable to the problems of education. There would appear to be special promise in the development of procedures to ensure continuity of perceptual responses. Such procedures would not only be helpful in the study of perception, but might suggest to the educator those procedures which are helpful to ensure learned responses other than perceptual responses, in which he has an even greater interest.

CHAPTER VI

SUMMARY

Children matched in age and town from normal classrooms, and classrooms for the educable mentally handicapped (EMH), and children matched in age from an institution for the mentally handicapped (IMH), were individually run in a series of psychophysical and other perceptual tasks. The tasks were run in a campus laboratory, and in a mobile laboratory constructed for the purpose. Over 200 children were run for the purposes of calibration, pretesting, and testing, the testing procedure involving about 50 children in each of the three groups. Ages ranged from 8 through 16, and IQ scores from below 60 to 120 and over. The visual tests run were part of a larger study involving tests of intelligence for the purpose (for this study) of grouping (supervised by Dr. Leslie Malpass), and auditory tests (supervised by Dr. Chester Atkinson).

The tests run were the following:

Psychophysical tasks. Two tasks were involved. In one case, a single solid white circle appeared on a large screen. In the other case, four solid circles appeared on the screen, one of the four being smaller than the other three, which were equal in size. The single circle (absolute discrimination) and the smaller circle (size discrimination) were varied in position (up, down, left, or right), and in intensity (ranging from fully visible and invisible in various steps).

Orders of intensity and sequences of locations were arranged in accord with a preset schedule. The series were photographed on film produced for the study. There was automatic control of sequence, voltage, stimulus duration, interstimulus interval, signal bell interval, with monitoring of voltage, current, and light in the booth and the projector.

Zeroing-in period. Prior to each task, voltage was systematically lowered until each child was locating the signal involved at levels of 50% above chance. The variac was then fixed at this point.

Psychophysical period. With the variac fixed, each subject was then given 128 presentations during which sequence of locations varied automatically, and polaroids were rotated to increase and decrease projector transmission above and below the subject's zeroing-in point, proportional in step sizes for each subject. Subjects were required to give two responses upon each presentation: to locate the signal (up, down, left, right) whether they had seen it or not, and to indicate whether they had seen it in the position called out. These responses were of three kinds: a 2 for signal seen; a 1 for signal unseen, but a difference noted in the position called out; a 0 for nothing seen.

Reaction time tasks. Subjects were required to turn off a stimulus as soon as it appeared. This could be either a red light, a white light, or a buzzer. Under certain conditions, they were scrambled in order; under others, they were blocked. Two measures were taken: time between onset of stimulus and lifting finger from starting key (lift time), and time between lifting finger and putting out stimulus by pressing the shut-off key (traverse time).

Size constancy tasks. A series of triangles, differing in size, was presented to the subject one at a time. Another triangle in the

distance was varied in size, with the subject being required to stop it when it matched the one before him. Two distances were used, one involving direct viewing, and the other viewing through a mirror.

Illusions. Single units of the Muller-Lyer illusion, which involves equating a longer variable line with a shorter standard line, and single units of the Titchener Circles illusion, which involves equating a smaller variable circle with a larger standard circle, were each mounted on a card, so that different orders could be tried. Subjects were required to indicate the cards at which equality occurred, as well as indicate whether variable or standard were longer.

Color tests. Pseudoisochromatic plates were given to subjects for report of location and type of figure.

Results were analyzed as functions of chronological age, IQ, and group (normal, EMH, IMH).

Results. The major results were the following:

1. Voltage required for accurate location of smaller circle and absolute circle. This was found to be independent of IQ, but inversely related to age. The older the child, the lower the voltage needed to localize five out of eight correctly.

2. Reaction time. Reaction time was found to be an inverse function of both age and IQ. Traverse reaction time was longer than lift time only at the lower IQ's, thereafter being quicker. The two types of reaction time had different curves and related to the variables of the study in different manners.

3. Overestimation in retarded groups. Children of lower IQ's were found to give responses which can be characterized as overestimative. In the phenomenal report tasks of the psychophysical sessions, they tended

to give more of the definite type Yes responses (the 2 responses) than did normals. Further they gave more false alarms, that is, reports of having seen the signal in a given location when their location of it was inaccurate, that is, no signal was presented in that location. They tended to report seeing the stimulus at intensities too low for recognition. In the size constancy tasks, they tended to overestimate the size of the variable triangles more than did the normals. This overestimation persisted even when the difference in reaction time was such as to produce underestimation.

4. Responses as a function of method. Use of differing psychophysical methods (ascending, descending; scrambled, ordered), psychophysical indicators (2-1-0; left, right; equality; semantic, accuracy; and so on), perceptual variables (direct vision, mirror vision) produced markedly different results. In certain combinations, the developmental relations with perception hitherto obtained were obtained, and in other combinations were not.

5. Difficulties in collecting data. It was noted that it took far more time to collect data from retarded children than it did from normal children. Constant prompting had to be applied, and constant retraining had to be utilized. This resulted in the loss of a considerable number of subjects. Their responses tend to fall off as the session progressed in time from the initial training period; they became more erratic.

5. Color data. The incidence of color blindness found for both normal and retarded subjects coincided exactly with expected incidence.

These findings were discussed in terms of their relationship to current educational practice and to practice and research in perception

and education.

With regard to educational practice, it was speculated that the overestimation which characterized the retarded children of almost all ages, but which characterized younger normal children, and then decreased with age, might be a function of the segregation, accompanied by permissiveness, of these children from others, for purposes of educating them and not impeding normal learners. Such segregation might not subject these children to the aversive consequences of overestimative responses, and might maintain such responses at a continually high level. A possible solution offered involved the use of teaching machines, with the aid of which each child learns at his own rate, thereby meeting the educative purposes of segregation, but not necessitating segregation at other times.

The data on differential reaction times was considered as supporting K. U. Smith's views on the differential susceptibility to training of different components of a seemingly unified response, and suggested further research in this area.

With regard to future perceptual research, the alteration of curves obtained as functions of the method used suggested that conceivably many curves currently regarded as perceptual may be functions of the peculiar combination of variables controlled, rather than perceptual functions. Psychophysical and other perceptual methods were discussed, and the laboratories of the former were considered as supplying methods which might be useful in developmental studies, since the specifiability of stimuli used facilitated analysis of variables involved in results obtained. Further research was suggested.

With regard to the nonperseveration of perceptual responses by

the retarded, this was suggested as directing our attention to the operant conditioning laboratory, where such control over behavior is part of the investigative procedure utilized. The application of such procedures to the responses of mentally retarded children was considered as a promising avenue for research and understanding of these children.

A research method involving the impingement of many responses occasioned by the same stimulus presentations was presented as a means of isolating variables involved. This was considered as an outgrowth of procedures developed under controlled laboratory conditions, and the possible contributions of this type of research were considered; currently, research in this area is not typically characterized by these controlled laboratory procedures.

It is concluded that further laboratory research in these areas may provide more information of use in education of the mentally retarded, and may provide more definitive statements than those made thus far about the relationship between retardation and perception, and the development of perception.

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